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Article

Challenges Necessary for the Development of Truly Intelligent AI. What Is Intelligence?

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Abstract: The question of whether AI is really intelligent is important to see if we are on the right track, or if we need to include other technological elements that we don't use yet, or if we need to research and develop them, because artificial intelligence really isn't that intelligent. At least not in the way we are told, because it cannot even solve a common elementary logic problem. This is one humble opinion among many others, some for and some against, on whether AI is intelligent or not that are being generated by the current trend towards large and technologically powerful computing systems. If Mexico, or any other country, wishes to play an important role in the development of truly intelligent AI, it must seriously consider the research and development of new technologies and software that will allow it to operate under an intelligent system in complete harmony with ethical criteria and whose productive approach is based on an environmental balance with various normal media, such as technological manufacturing, industrial production, scientific research, educational and social, among the most important. This article proposes some important challenges for the correct configuration of information and warns against the growing use in any solution made by IA, because it will make a great mental laziness of the human race, consecutively its involution.

Keywords: imagination; reasoning; understanding; perception technology; interpetration technology

1. Introduction

The term *"artificial intelligence"* [1] was first coined one day in 1955 by John McCarthy (1927, 2011) (a mathematician at Princeton University and a computer scientist), but there were already important precursors. Since 1945, scientists Warren McCullough (1898, 1969) (a neurophysiologist) and Walter Pitts (1923-1969) (a mathematical logician) had developed a model of artificial neurons, described in their book *"A Logical Calculus of the Ideas Immanent in Nervous Activity"*. With them, computational neuroscience began and was consolidated by the significant contributions of Alan Turing (1912-1954), who had to deal with the encryption complexity of the *"Enigma"* machine, designed by the German engineer Arthur Scherbius (1878-1926) and used since the First World War. However, Turing had many other important contributions and influences on the future development of AI. In a 1950 publication in his weekly journal *Computing Machinery and Intelligence*, he asked ***"Can machines think?"*** [2]. This led to the *"Turing Test"* algorithm and his conception of an abstract machine called the *"Universal Turing Machine"*, as well as his research in *"Probability Theory"* and the proof (1935) that the mathematical logic algorithm that produces a definitive **"yes"** or **"no"** solution has no solution, known as the **(decision problem)** used in *"Formal Logic"*, which served as the basis for Gödel's formulation of his ***"Incompleteness Theorem"***. But all of this has its foundations in theories and schemes from long ago, which we will highlight in the *"Pioneers"* section of this article.

The concepts discussed in this study are not new and have been widely debated by the most brilliant minds of our civilization. But there is deep concern about the unpunished manipulation that AI can exert, directing it toward the interests of hegemonic, anti-democratic governments, distorting the truth and manipulating public opinion. It is obvious that the hegemony of a sinister or benevolent power will be based on the wealth of information gathered for the use and training of AI.

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The only difference is my personal approach, which tends towards a deeper search for what intelligence can essentially be, from the perspective of the human being and his relationship with an artificial intelligence that is developing and will surpass him because it is unconditionally supported by the largest historical investment that no other technological innovation has received, both financially, technologically, and scientifically.

Trying to understand what intelligence really is and its application to the hyper advanced servers of our time does not mean that we do not recognize that it is not the most exalted and extraordinary innovation of our intellectual evolution, because as a technological tool it is currently the most advanced we have achieved as a civilization and will undoubtedly be very useful in the search for new hidden stigmas in our universe, both in its cosmological dimension and in its microcosmic environment where our natural perception lacks the capacity to see. But this does not mean that AI is intelligent, because it is simply a very powerful machine capable of skillfully processing and reading vast amounts of information, quickly, and using mathematical strategies [3] for debugging, positioning, and verifying where the most certain probability brings it closer to the desired solution. The key to its success will always be the quality of the information or data input given to it, because consequently it will be the quality of its response, which means that it will be possible to generate highly valuable scientific answers or strategies of defense, war, and/or extermination in the case of a militarized AI. Then, like any technological tool of our time, it will depend on the interests of the user and the purposes for which it is used.

2. What is Intelligence?

We don't yet have a definitive definition of what intelligence is, but we do distinguish the qualities that something or someone must possess in order to claim to be intelligent. I am going to highlight three of the most important qualities that any being that claims to be intelligent must possess.

1. Imagination.
2. Reasoning.
3. Understanding.

2.1. Imagination

Imagination is the quality that allows us to create something out of nothing, something that is intangible in its first stage. It emerges from inanimate fantasy to give form to the imagined thing through an intelligent process. To achieve this, the imagination relies on a very powerful motor system: thought. The motor system, the thought of the imagination, is what brings order to the stochastic process of imagination. Imaginative activity is initially chaotic and must strive for order (paraggelia) if it is to realize its fantasy. Therefore, every intelligent process begins its development with the energy transformed into action by imagination and thought. At this point, the concrete expression of what is imagined begins to take shape but still within the realm of imagination. This allows it to be modeled in different ways, because it is very easy to construct, destroy and/or reconstruct it, because it has not charged us with anything yet.

2.2. Reasoning

Reasoning is a process that seeks to give order to the imagined being. It takes it from the previous process with certain criteria already defined but not detailed, so it must develop the entire engineering of its construction and operation, specifically establishing its know-how, which implies the philosophical reason why and for what purpose it was created. Reasoning includes logical and illogical foundations, so that what is conceived becomes a masterpiece, thus fulfilling the principle of existence, which tells us that only that which has been constituted and has reached the sublime degree of being a masterpiece can exist. A true masterpiece created by man or by nature itself, but exploited and used by man, such as silicon and water, to name a few masterpieces of nature, among the immeasurable

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resources we have at our disposal. Reasoning is capable of visualizing the imagined whole, while at the same time dissecting its parts to analyze their structure and strategy, with the goal of putting them in the right place and, above all, strengthening their functioning as an integrated whole, so that it acts as a unit and, if part of a larger whole, performs its corresponding part to fulfill the purpose of the larger whole. Reasoning, like imagination, has its source in the mind, but it is in its field that the questions of all that is to be formed are accentuated. Questions, many questions... any answers, probably some statements that are proven and verified, although new questions arise because the field of reasoning and imagination is extremely dynamic, and just as the fantasy of something appears, it also disappears, so it is a priority to ground what is worth creating. Then, thinking repeatedly rearranges, visualizes, measures, re-visualizes, quantifies, re-visualizes, re-edits, and thus separates the possible from the impossible, the permanent from the ephemeral, so that imagination is not sterile. In reasoning, thought has a greater responsibility because it must configure each phase, each strategy, and each enhanced visualization with a high probability of being created. In this phase, thought is more analytical, more critical, more philosophical, unlike the phase of imagination, where it allows itself to be enveloped in the frenetic activity of fantasy, but it is necessary for it to be aware of all the knots and edges of the imagination.

2.3. Understanding

Understanding is the culmination of this entire phase of creation, but it is essential to give the creation of imagination the final and most important quality that has brought reasoning to a successful conclusion: **Language**. The fundamental meaning of what is created is its cognitive interaction with other beings also created in its image or likeness, or not, but with the same status of being masterpieces. It doesn't matter whether you have the other qualities of being a living being or not, intelligent or not, because in the totality of its environment, the interaction between each and every one of the living or inanimate elements that compose it is of utmost importance, and harmonious coexistence is achieved based on the intellectual capacity of understanding, especially those that claim to be intelligent beings. But understanding gives greater meaning to creation, and if it is alive, it is much more transcendent, since it allows it to address a new category of imagination and fantasy: the understanding and elaboration of concepts, where the concept is so abstract and concrete at the same time that imagination and thought revel in it, so that their insight allows them to consciously consolidate a platform of true scientific principles and foundations. Understanding is the key to determining whether a being is intelligent or not, for it is essential that it possess this ability, otherwise its creation would be meaningless, neither to it nor to anyone else. Understanding is a subtle change, and language is conceived within it. The language that will allow it to express its essence through symbols, graphics, sounds, colors and intensities of light and darkness, constants, variables and mathematical functions. The language that will allow it to know itself, others of its own nature, and others different from itself. The language to concrete concepts and define its fantasies. Then, in the spoken, written, or symbolized word, all wisdom will be united, making your reasoning and thinking more eloquent, thus successfully closing the circle of creation in an act of imagination that came from nothing.

The most fundamental quality of any intelligent being is to be alive. [1]

To be or to be a living being on all the multidimensional levels that may exist. But I will only give some nuances of this, because discussing life in terms of bioengineering, intelligence, feelings, beliefs, abilities, and transcendence is a very broad topic that would go beyond the purpose of this article. To be alive is to remain in a continuous, highly dynamic process, receiving a vast amount of information at each moment, which is also processed and used in that moment to continue living in the next moment.

[1] Life has an energetic field that we do not yet understand because we know it only through the somatic manifestation of its physical expression. Understanding it in depth means discovering how it develops its intelligent process of wise adaptation to an ever-hostile physical environment. It implies understanding its multidimensional nature, its true origin, and many other virtues and qualities that are beyond the scope of this study.

 doi:10.20944/preprints202504.1964.v1

In other words, life is a continuous training to strengthen our learning abilities and survival strategies. That is why every living being evolves not only physiologically but also intellectually, in all its abilities, in all its virtues or defects, depending on what it is trained.

3. Challenges and Expectations of a New Artificial Intelligence

Of the above qualities, AI has only one: the expression of language in all its forms and manifestations, modeled on human language and understanding. But it is a machine language that does not perform acts of imagination, reasoning, or understanding. Its imaginative potential is limited by the data centers and Internet networks that feed it, in any case, if we were to ascribe that quality to it, it would not be free imagination. Its processing is conditioned by the nature of the input information, [4] and it focuses on it to provide its response. Although it is now capable of generating textual content, images, and the sequence of images in the fourth dimension (video), it is limited to the information previously processed by us, so it will make copies, and only copies, ingeniously structured by the vast array of sources it draws upon.

Certainly, all this is very valuable, because a single task performed by it saves man a lot of work and multiple mistakes. However, its technological complexity is marvelous, but it is still inanimate. However, due to this complexity and the similarity that has been developed to emulate the nature of the human brain (Liquid Neural Network (LNN)), it is possible to recognize it as a semi-animated being, although it still has a long way to go to achieve this status. So far, AI does not have the qualities of a truly intelligent being, although research is being done to provide it with a better algorithm on a liquid reservoir that can receive information over time and respond to that information, adjusting its output and reconfiguring its neural network to adapt to new circumstances. It requires fewer parameters, which are trillions of times smaller compared to artificial neural networks, which also means significant energy savings. For example, we know that GPT-3 requires 175 billion parameters and 1,287 MW/h of electrical energy to run, but GPT-4 is 10 times more powerful but requires an energy supply of 41,037 MW/h and 1.7 trillion parameters. The energy used is equivalent to the monthly consumption of 47,000 American households, hence the need to build gigantic data centers. In my opinion, this is unaffordable in terms of energy and is not sustainable in the future. Only the country or companies, as Blackrock, that can spend large amount of money, beyond to 50 billion dollars, can build this kind of projects. This obviously bring to them the control of information of everyone and the power of over all kind of decisions.

Compared to our brain, which consumes only 175 kWh per year and gets that energy from the calories in the food we eat. This represents a very large gap between the brain and GPT-4, as much as: 234,000 times larger from now on. The importance of improving neural networks in terms of how they work and the correct interpretation of the signals they process, because it is not enough to know whether they are activated or not, or how they are activated, but rather what kind of information they are actually processing, because the stimuli and responses certainly imply a natural language that we do not yet understand.

The language we use is certainly natural to us, but not to neurons. Their language must be simple, but more powerful, so much so that we have been endowed with the ability to form our own language and intelligence.

I suggest that the natural language of neurons is probably based on an elementary mathematical structure in DNA that we still do not understand.

3.1. Proposal

For AI to take hold in the not-too-distant future, the following new technologies must be developed to make it independent of large data centers and their unsustainable energy consumption.

1. Its training ground should be the environment itself, with its infinite innumerable stimuli in its diverse physical and energetic variables.

 doi:10.20944/preprints202504.1964.v1

2. The development of a new numerical system that extends logic to elements of simultaneous and discrete positive, negative, and neutral states [2] in a multivariate frequency pattern, without reaching the indeterminacy of quantum states.
3. The development of new software, based on the logic of the triadic number system, capable of correlating each variable and its product in a response feedback by the environment, in order to determine its validity, so that it satisfies the most accurate solution among the multiple options that may exist.
4. The development of **perception technologies**, translated into their original energy source, so that their elemental management is a manageable platform, yet perfectly distinguishable from each other, in such a way that the nature of the person issuing it, the person expecting an evaluation or a response is recognized.
5. The transformation of the digitization of information into analog information signals, which is the natural form in which it emerges from the depths of the digital elements, since its quantification at the physical level of energy manifestation can only manifest itself in unquantifiable conglomerates that now form the innumerable elements of the environment that can only be measured analogically.
6. Transfer and imprint the entire memory of the system into the environment, so that its ability to focus solely on its interrelationship with everything around it, to integrate wisely into its environment,[3] and to apply it to various tasks results in a positive effect on each of its decisions.
7. Develop **interpretation technology**. Logic gates must be configured in an arrangement [4], that allows the direction, intensity, and intent of signals to be discerned so that the AI can focus on its perception, correctly define the problem, and derive its best response.
8. Develop software that associates each analog signal in the basic information set with its corresponding cluster and is able to use the same elements to generate its response, given that the answer to a specific question lies within the same set. Develop extremely robust security software that is completely independent of any data center, embedded only in multimedia devices, with a unique and universal key to navigate the web's network.
9. Constitute a multidisciplinary research and development team of true innovators, where even the most absurd ideas have an analysis process to discern their potential.
10. Constitute an organization of testing laboratories for the development of materials. For the research and development of neuroscience with its various specialties, such as: neuroenvironment, structural neuroartificial, natural neurolinguistics, and the advancement of mathematics, logic and illogic, physics and philosophy. To promote social development in conjunction with AI in its psychosocial [5], self-identification, human-machine interaction, cultural and political neutrality.
11. To transform the current educational system into a psychomotor-intellectual model of assisted and guided natural learning, but in a free and autonomous process [6] where children, adolescents, young adults and professionals discover their most outstanding abilities and, in their development, experience full satisfaction from their contribution to their life's purpose and social recognition.

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[2] A new triadic number system has been developed, which extends up to the 9th. base but is structured in the 7th. base. Along with this system, I am developing a p-adic number system, which complements it as a prime binary system with a neutral element.

[3] It should be noted that the purpose of any technological and scientific creation is to be useful, and this property is based on the interaction with the elements of an environment, physical, energetic or intellectual, according to the capabilities with which it was designed

[4] The current neural network is a good start, but it needs to be implemented with more robust backpropagation instructions.

[5] It means providing AI with an autonomous ethical judgment algorithm

[6] The true transformation of a nation is based on the excellent productivity of its educational system, where citizens of the highest quality and value are forged.

 doi:10.20944/preprints202504.1964.v1

12. To establish high-performance centers or institutes for advanced studies with the best students and researchers who are deeply committed to the challenges of innovation in all sciences and technologies that contribute great value to humanity.
13. To establish international exchanges with all nations, with a significant mutual academic, scientific, and cultural impact.

If, in the future, we enable AI with a more complex algorithm that allows it to follow a line of reasoning that is free and dynamic over time - that is, not fixed or limited to a data center, but to the abundant information of its environment with which it must interact wisely - then AI will surely be nature's friendliest cohabitant, and only then will we truly begin the path to artificial intelligence, with improved intellectual attributes and greater certainty in its results.
At present, the progress of AI technology is really stronger, and useful in many fields of science and human tasks, but not enough to develop a common sense reasoning.
An example of what the current technological of AI could not suggest, or reason, is the following paragraph:

"We must learn to see the universe entirely as a mathematically structured body, because the number is the essence of all that exists. Numbers are born out of the need to fill infinity, because infinity seeks and struggles to end the emptiness of nothingness, but nothingness transforms into the essence of number (Dedekind cut), so that a never-ending cycle is established and consequently the existence of nothingness can be conceived, so that if nothingness exists, everything else exists, because the existence of everything is due to the interaction between numbers, infinity and nothingness. This interaction does not occur in some distant and isolated place in the universe. It occurs in the intimacy of every inert being and in the essence of every living being that exists, because Nothingness, Infinity, and Numbers are omnipresent. All of this is based on our 4D physical perspective and focused on our current human understanding in an effort to understand the nature of our true reality. We will probably have pleasant surprises or discouraging news; we don't know yet because we will keep asking, ***"What is the Nothingness? What is infinity? What is the number?"***.

Obviously, after this article, if the AI will be trained on it, it will surely find patterns, does editions from it, and clam that the numbers are born for the interaction between infinity and nothingness.

4. Pioneers

True intelligence resides in all the people who made it possible, from the thousands upon thousands of anonymous programmers, to the men who designed the most sophisticated machines for making microchips with billions of nanometer-sized transistors, to each of the millions of workers who assemble every piece, wire, and trace on a motherboard, graphics card, or I/O board. But even more valuable is the wisdom of the great men who laid the theoretical physical, neuro-biological, and mathematical foundations for each nanoparticle of silicon or germanium to do its job efficiently, and all of them will be for the next generations of AI.
One of the most important and valuable foundations is the binary system, originally known as Boolean logic and first described in *"The Mathematical Analysis of Logic"* a work published in 1847 by George Boole (1815 - 1864) and *Formal Logic*, written by Augustus De Morgan (1806 - 1871), to come together as a tool of incalculable mathematical value in the work of John Venn (1834 - 1923) of 1894 in his book *"Symbolic Logic"* , from which the concepts for the mathematical treatment of sets and the practical application of the Boolean system were consolidated.
But this has its foundations further back and it is worth mentioning Isaac Newton (Julian 25/12/1642 / Gregorian 4/01/1643 - Julian 20/03/1727 / Gregorian 31/03/1727) and Gottfried Wilhelm von Leibnitz (1646 - 1716) where both consolidated theirs theory of calculus and many other scientific contributions of great value.
Another important contribution is that of Leonhard Euler (1707 – 1783) with the development of the most beautiful equation in mathematics and his immeasurable wealth of knowledge on astronomy,

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fluid mechanics, light in its wave property, defining his differential and derivative equations, whose formulas are the basis of many branches of current engineering and his outstanding contribution to number theory, among the most important.

Also fundamental is the analysis of Fourier series (1768 – 1830), as well as the contributions of Carl Gauss (1777 – 1855) and Richard Dedekind (1831 – 1916) in defining the nature of the set of real numbers. Thomas Bayes (1702 –1761), Ludwig Boltzmann (1844 – 1904) Boltzmann distribution of a stochastic process, among many other very important contributions, which confirmed the real existence of atoms.

Another valuable contribution is the research carried out by Santiago F. Ramón y Cajal (1852 – 1934) (Spanish histologist) who obtained important results in his research on *"The Texture of the Nervous System of Man and Vertebrates"* (1904), results that were key to the application of artificial intelligence in neural networks.

John Bardeen (1908 - 1991) and Walter Brattain (1902 - 1987) invented the transistor at Bell Laboratories in 1947, based on the theoretical work of Carl Ferdinand Braun (1850 - 1918). The name transistor was coined by John R. Pierce (1910-2002). Alan Turing (1912-1954) was the most influential scientist in the early days of computing, the precursor technology to modern AI.[7] It is the most revolutionary invention of the XX century, which will outlast the current millennium and probably beyond, even though we are on the verge of collapse according to Moore's Law. However, more malleable materials than silica and germanium will certainly have to be developed to allow us to manufacture components at the molecular and atomic level, or another type of energy of an intelligent nature, because we are certainly still in the primitive era of our civilization, given that our most advanced technological instruments are very energy inefficient and our society has not yet achieved the vision of a collective consciousness, but on the contrary is engaged in wars not only of extermination, but also ideological, cultural and economic wars of profound selfishness and greed.

The first transistor was commercially introduced for radio applications in 1952, and industrial production of transistors began in 1955, after the design had been refined and the materials and techniques for PNP or NPN junctions had been improved. A very significant contribution was made by the eight renegades who formed Fairchild Semiconductors, and from then on, large technology companies emerged that continued to improve the quality of semiconductors: Texas Instruments, Intel, more recently Nvidia and TMSC Semiconductor, assembly companies, and software research and development companies such as the Computing-Tabulating-Recording-Company (now IBM), among the most important. Others include Motorola and Philips-ASML. Programs such as Basic, Linus, Cobol, Fortran, and the modern Java, Python, SQL, among others, have been implemented.

But the consolidation of AI laid its foundations in the 1980s, with the pioneering work of Professors John Hopfield [5] of Princeton University and Geoffrey Hinton of the University of T. Canada, recently awarded the 2024 Nobel Prize in Physics.[6] My special recognition goes to Professor Karl Friston [3,4,7] of University College London and many others, neuroscientists, computer scientists and mathematicians, impossible to name them all in this space, but we recognize their invaluable work and dedication.

For present and future generations, the great challenge of building a truly intelligent artificial intelligence remains open. The journey has already begun...

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