International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

An Overview of the Problems and Challenges Associated with Artificial Intelligence in the Modern Era of Digitalization

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Abstract: ***Artificial intelligence (AI) is one of the most promising and at the same time controversial areas of modern technology. The introduction of AI covers various aspects of society, from medicine and industry to the social sphere and culture, offering significant improvements in efficiency and usability. However, progress in AI also faces a number of serious challenges, including ethical dilemmas, security concerns, risks of increasing social inequality and the possibility of exacerbating existing biases.***

Keywords: artificial intelligence, AI, AI problems, modern technologies, IT

1. Introduction

The introduction of artificial intelligence (AI) entails a number of serious challenges. One of the key challenges is the rationalization of AI's perception of the world, which may lead to a distortion of the essence of human existence, because the machine is unable to feel the emotional aspects of life. Another challenge is the issue of responsibility for AI's actions, which creates dilemmas regarding the legislative and ethical aspects of its use.

The difficulty of giving AI free will and questions about the sources of data for its training raise fundamental questions about AI's self - awareness and its capacity for creativity. Despite AI's ability to create artificial creations, true creativity requires surprise and value that can only be fully appreciated in the context of human experience. Thus, artificial intelligence represents both a means to reach new heights in human development and a challenge that requires deep reflection and a responsible approach to its design and implementation. It is important to strive for a harmonious coexistence of AI and humans, while preserving the uniqueness and uniqueness of human experience [2].

At the moment, the application of AI is expected in many directions: from the automation of production processes to the development of management decision - making systems, improving work safety and personalizing offers for consumers. The emphasis is on the fact that AI implementation should help optimize resources, improve the efficiency of organizations, and enhance the quality of service to citizens.

The application of AI is already having a noticeable impact on various aspects of society, including medicine, industry, education and many other spheres. In particular, in medicine, artificial intelligence opens up new opportunities for diagnosing and treating diseases, and in industry - for automating and improving production efficiency. The introduction of AI in the domestic sphere and services, including self - service checkouts and automated control systems, contributes to convenience and time - saving for consumers.

Nevertheless, the active development of AI imposes certain challenges, including the risk of job losses in a number of professions and the need for the workforce to adapt to new working conditions. In this context, the creation of conditions for retraining and development of skills that meet the requirements of the time is of particular importance.

In general, the strategy for the development of artificial intelligence in Russia until 2030 sets ambitious goals and objectives, the realization of which requires joint efforts of the state, scientific community and business. The experience of world leaders in AI demonstrates the importance of effective planning, investment and continuous improvement of technologies to achieve significant results in this field [3].

2. Literature Review

For the best understanding of the essence of artificial intelligence, it is necessary to turn to reflections on the nature of intelligence in general. The views of Thomas Aquinas, distinguishing between intelligence as a divine essence and human possibility, combined with John Searle's axioms that consciousness is generated by the brain, emphasize the question of the possibility of creating an artificial intelligence with causal properties analogous to the human brain.

The problematics of AI is particularly prominent in the context of its difference from human thinking, emphasized in the works of A. N. Leontiev and Alan Turing. The Turing test as a measure of AI's ability to imitate human behavior raises the question of the limits of the machine's "thinking".

In turn, this paper will explore this topic in detail. The research is based on a comprehensive analysis of scientific literature, legislative acts, as well as cases from the practice of AI application in various spheres. Additionally, data from surveys and interviews with AI experts are used to obtain multifaceted views on the topic under discussion.

3. Challenges

One of the significant challenges facing artificial intelligence (AI) is its difference from the human brain in understanding and processing information. This difference makes AI vulnerable to errors in data interpretation, which sometimes leads to unpredictable results, especially evident in image recognition systems. AI analyzes images based on a set of pixels without an in - depth understanding of the context, which sometimes makes it easy to mislead.

An illustration of this vulnerability was an experiment conducted by Google researchers in 2013, when a slight change in the color of individual pixels in images caused the neural network to misclassify objects, for example, a panda was mistaken for a gibbon and a sloth for a race car. The experiment emphasized that AI perceives images solely as data, ignoring their semantic content.

The difficulty in understanding the mechanisms of AI operation is also manifested in the problem of the so - called "black box", when even the creators of the system cannot explain the logic of decision - making by the algorithm. An example is the Deep Patient AI, which is able to predict with high accuracy the development of serious diseases, including mental disorders, based on the analysis of medical records. However, the mechanisms behind its conclusions remain unclear to both medical professionals and developers.

Ethical issues are also a significant challenge. For example, in commercial development, ethical issues related to the use of artificial intelligence (AI) are at the center of discussions among specialists. One of the landmark moments was an incident in 2018, when Google terminated its cooperation with the Pentagon on the Maven project after mass protests by its employees. The developers expressed fears that their labor could be adapted for lethal weapons purposes, which led to the formulation and publication of corporate ethical principles for working with AI. So far, the world has recognized more than 84 such documents regulating AI activities in various companies and organizations. Despite this, the Pentagon has been able to attract specialists from Silicon Valley, pointing to the continued involvement of the technology sector in military projects.

Based on AI's lack of consciousness and its own ethical principles, the responsibility for its use falls on customers.

The involvement of human labor in the development and training of AI, as well as the environmental impact of this process, stand out as significant problems. Multitudes of people around the world are involved in creating and adjusting training data for AI, often receiving inadequate remuneration for their labor. At the same time, training AI requires significant energy inputs, increasing the carbon footprint of the technology. These aspects emphasize the material and environmental costs of creating artificial intelligence [1].

The widespread adoption of AI may have significant social implications. It may exacerbate existing inequalities if access to AI technologies is restricted to a privileged few. In addition, AI - powered systems may inadvertently reinforce biases present in the data on which they are trained, leading to discriminatory results. It is critical to address these biases and ensure that AI technologies are designed with inclusion and equity in mind [4].

Artificial intelligence is designed in such a way that it draws a conclusion based on a large amount of information about something, which may be wrong. In addition, the AI database itself may be of poor quality. Due to the limited number of data, the problem arises that artificial intelligence is not able to draw conclusions about objective reality - it creates its own reality [5].

Overcoming bias represents one of the biggest challenges facing artificial intelligence (AI) as it evolves. The difficulty is that AI algorithms can incorporate biases embedded in training data that reflect human perceptions of gender, race, and other socially relevant characteristics. An incident with Amazon's recruitment system in October 2018, when it was revealed that the algorithm was showing bias against women, is just one example. The problem is exacerbated by the fact that the algorithms were trained on male - dominated data over a long period of time, leading to the development of a biased model for evaluating candidates.

In addition to bias, AI faces cybersecurity challenges. The complexity of securing AI systems is related not only to the need to protect against external threats, but also to the integration of security measures throughout the development and operation of the systems. The fundamental dependence of AI on large amounts of data, often containing sensitive information, makes the systems vulnerable to attacks aimed at data leakage or theft. With even existing data protection measures, such as the EU General Data Protection Regulation (GDPR), failing to completely eliminate risks, the need to develop and implement comprehensive AI security strategies comes to the fore [6].

In turn, there are also issues related to the creation and preservation of data sets. The utilization of data obtained from multiple sensors is the foundation for AI systems applied to business processes. The verification stage of such systems involves analyzing huge amounts of sensor information. There are cases when irrelevant or distorted elements prevail among the collected data, which significantly complicates their subsequent storage and analysis.

Optimal functionality of artificial intelligence is achieved when a large database of high quality is available. As the amount of relevant information increases, AI algorithms demonstrate increasing efficiency, while the lack of high - quality data leads to a decrease in their performance.

However, there is an opinion that quality data will dry up in 2 years and there will be nothing to digitize, after that the AI world will finally enter the world of synthetic data for training, where the synthetic underlay will be so large as people will be too lazy to write and AI will do it for them. This in turn will have a direct impact on the accuracy and stability of AI, as it directly depends on the quality of the data used, emphasizing the need to improve the methods of data processing and analysis. Additional challenges arise in industries where there is a shortage of information resources,

limiting the potential of AI applications. Consequently, the task of not only increasing the quantity of data, but also improving their quality is becoming more relevant, which requires the development of new approaches to the collection, storage and processing of information in the context of the use of artificial intelligence [7].

Another challenge is also energy, as there is a prediction that in 5 years 7% of all US energy will be powered by AI graphics cards, so it is interesting to consider how AI can be the most energy efficient. In this regard, SNS is a way to overcome the limitations of neural computing and effectively utilize machine learning algorithms in real - world applications is. This concept, is a third generation neural network, is inspired by biological mechanisms capable of efficiently processing discrete spatio - temporal signals, or spikes. Spike neural networks have low resource consumption when processing large amounts of data. Due to than SNNs are a promising computational method capable of modeling complex information processing.

Currently, the pulse neural network or spiking neural network is used, which represents the third generation of artificial neural networks (ANN), which differs from binary and frequency ANNs by the fact that in it neurons exchange short (in biological neurons - about 1 - 2 ms) pulses of the same amplitude (in biological neurons - about 100 mV).

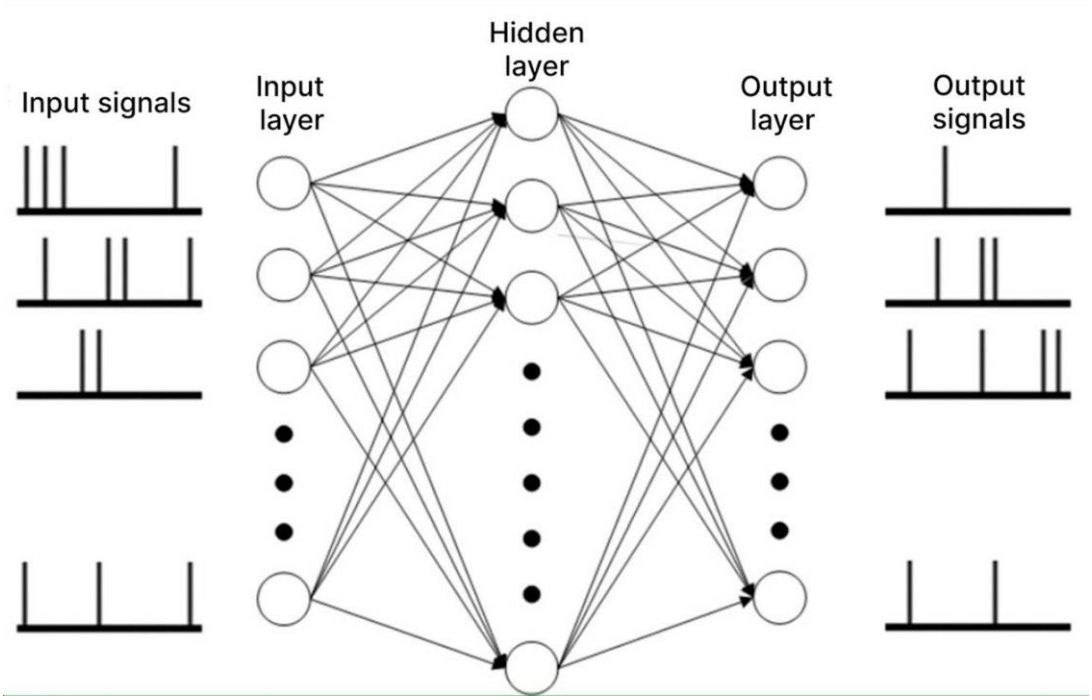

Figure 1: The spike neuron model.

It should also be said that impulse neural networks represent a class of formal models of brain neuronal ensembles that allow solving the above problems using the same principles that underlie the functioning of biological neurons. The information that is transmitted from neuron to neuron is an object with no other attributes than the time of its generation. In the brain, it corresponds to a nerve impulse or spike transmitted from neuron to neuron through a synaptic network. The functioning of a neuron manifests itself only as its generation of spikes. The time a neuron generates spikes depends only on the spikes that arrive at its synapses. The functioning of different neurons is not synchronized with each other in any obvious way.

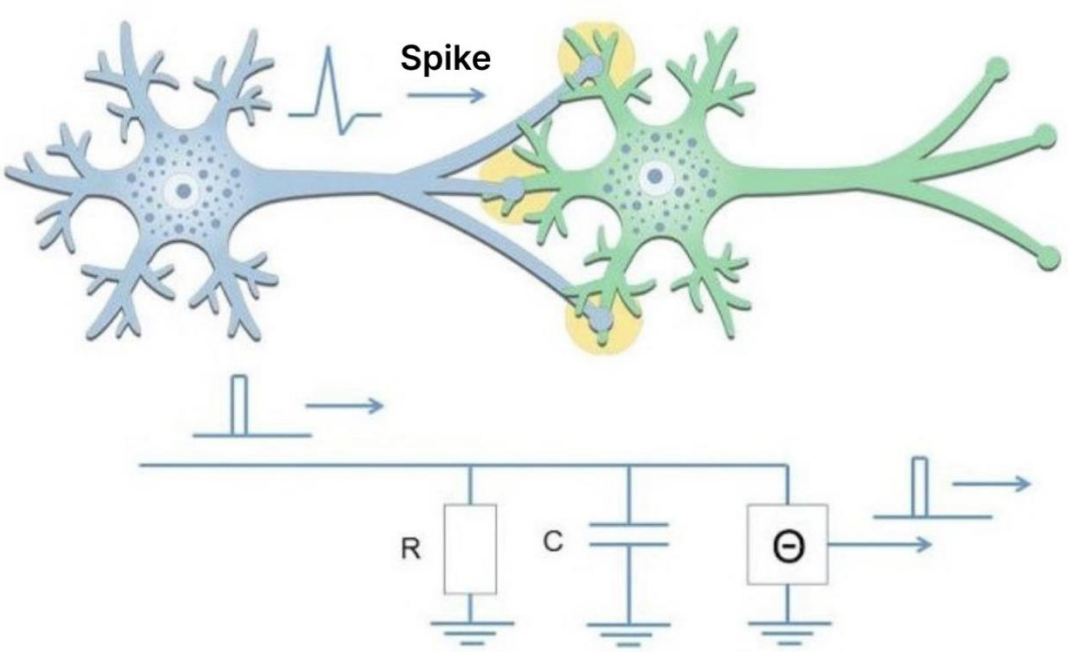

Figure 2: Model of a pulse neuron

Fig.2 shows that the most basic operation on which the functioning of ANN is based is the fixation of coincidences of spike passes to different synapses. It is also the most realistic, in terms of physiology, model of ANN.

In turn, spike generation is shown in Figure 3.

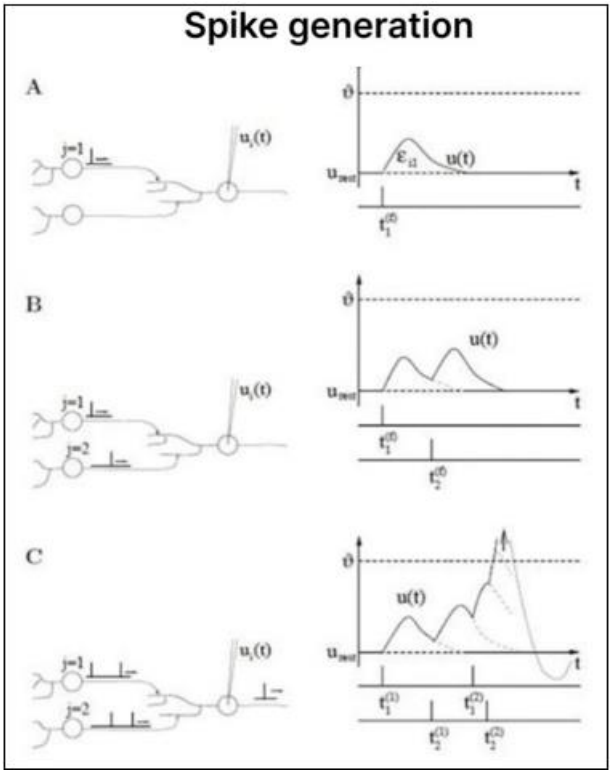

Figure 3: Spike generation

Figure 3 shows that there are two inputs and spikes are coming in, the first time a spike came in, but nothing happened because it did not reach the threshold potential. The second time also nothing happened, although 2 spikes came in, but they were not enough. But on the third time, the spikes came often and there are a lot of them, so they exceeded the threshold potential and just generated a spike at the output. The point is that the one - dimensional model - the state of a neuron is described by its membrane potential, which in turn depends only on the time of spike arrival and the time of generation of the last spike. The synapse weight determines the amount of injected charge [8, 9].

4. Conclusion

The solution to the above - mentioned problems requires a comprehensive approach that includes the expansion and deepening of training databases, the introduction of self - learning mechanisms among AI systems to improve their ability to critically analyze and adapt, and the development of techniques to enable AI to master fundamental concepts such as space and time. An important part of the solution is also the development of interdisciplinary dialog aimed at shaping ethical norms and standards in the field of artificial intelligence.

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