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The Use of Machine Learning and Neural Networks in the Digital Economy and International Digital Integration

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Annotation: This article analyzes the development of artificial intelligence, discusses the use of machine learning and neural networks as one of the areas of artificial intelligence.

Keywords: artificial intelligence, neurocybernetic approach, logical approach, algorithms, machine learning, neural networks.

Artificial intelligence (AI) has a long history that goes back more than half a century. Previously, AI research was hampered by a lack of computing power. The current infrastructure and ecosystem have allowed artificial intelligence to start "thinking". The amount of memory and data processing capabilities, cloud computing, high-speed fiber-optic communication, the ubiquity of Wi-Fi and the Internet of Things - all this creates ideal conditions for the development of AI [1].

Twenty years ago, only large companies were working on AI, now every developer has access to a fast connection, powerful devices and technological infrastructure created by large corporations. Never before has there been such wide access to huge amounts of data about people, especially in the public domain. Thanks to all these new introductory materials, almost anyone can do research in the field of AI.

Despite the long history of the development of artificial intelligence, there is still no single definition and understanding of artificial intelligence.

Intelligence (from Lat. intellectus - sensation, perception, understanding, understanding, concept, reason), or mind is a quality of the psyche consisting of the ability to adapt to new situations, the ability to learn and memorize based on experience, understanding and applying abstract concepts and using their knowledge to manage the environment. Intelligence is the general ability to cognition and solve difficulties, which unites all the cognitive abilities of a person: sensation, perception, memory, representation, thinking, imagination.

In the early 1980s, computational scientists Barr and Feigenbaum proposed the following definition of AI. Artificial intelligence is a field of computer science that deals with the development of intelligent computer systems, that is, systems with capabilities that we traditionally associate with the human mind - language understanding, learning, the ability to reason, solve problems, etc. [2].

Now AI includes a number of algorithms and software systems, the distinctive feature of which is that they can solve some problems the way a person thinking about their solution would do.

The main properties of AI are language understanding, learning, and the ability to think and, importantly, act.

In connection with the evolution of the concept of AI, it is also necessary to mention the so-called AI Effect. The AI effect occurs when observers devalue the importance of demonstrating AI skills every time it actually achieves a previously unthinkable result. So, the author Pamela McCorduck writes that part of the history of the field of artificial intelligence is that every time someone comes up with how to teach a computer to do something well - play checkers, solve simple, but relatively informal problems - there is a chorus of critics that this is not proof thinking and not AI. This effect is described even more succinctly by computer scientist Larry Tesler, distilled into Tesler's capacious theorem: "AI is everything that has not been done so far."

Since the late 1940s, research in the field of modeling the thinking process has been divided into two independent approaches: neurocybernetic and logical.

The neurocybernetic approach belongs to the Bottom-Up type (Eng. Bottom-Up AI) and suggests a way to study the biological aspect of neural networks and evolutionary computing [3].

The logical approach refers to the top-Down type (Eng. Top-Down AI) and means the creation of expert systems, knowledge bases and logical inference systems that simulate high-level mental processes: thinking, reasoning, speech, emotions, creativity, etc.

Artificial intelligence has a rather extensive history, which originates from the works of Turing, dated to the middle of the XX century. Although the conceptual prerequisites appeared even earlier, in the Middle Ages, when Rene Descartes suggested that an animal is a kind of complex mechanism, thereby formulating a mechanistic theory. In the 1830s, the English mathematician Charles Babbage came up with the concept of a complex digital calculator - an analytical machine that, according to the developer, could calculate moves for playing chess. And already in 1914 The director of one of the Spanish technical institutes, Leonardo Torres Quevedo, has manufactured an electromechanical device capable of playing the simplest chess endgames almost as well as a person [4].

In 1954, the American researcher Newell decided to write a program for playing chess. Analysts of the RAND Corporation were involved in the work. As the theoretical basis of the program, the method proposed by the founder of information theory Shannon was used, and its exact formalization was performed by Turing.

Since the mid-30s of the last century, since the publication of Turing's works, in which the problems of creating devices capable of solving various complex tasks independently were discussed, the problem of artificial intelligence in the world scientific community began to be treated carefully. Turing proposed to consider such a machine as intelligent, which the tester in the process of communicating with it will not be able to distinguish from a person. At the same time, the term Baby Machine appeared - a concept involving the training of artificial intelligence in the manner of a small child, and not the creation of a "smart adult" robot right away.

In the summer of 1956, the first working conference was held at Dartmouth University in the USA with the participation of such scientists as McCarthy, Minsky, Shannon, Turing and others, who were later named the founders of the field of artificial intelligence. For 6 weeks, scientists discussed the possibilities of implementing projects in the field of artificial intelligence. It was then that the term artificial intelligence itself appeared - artificial intelligence. And it was after this summer meeting that the "first summer" in the development of projects related to this area came.

As you can see, after the famous conference at Dartmouth, artificial intelligence has received an impressive development. Machines were created that could solve mathematical problems, beat chess, and even the first prototype of a chatbot that could talk to people, misleading them about their awareness.

All these significant steps forward in the field of artificial intelligence occurred as a result of serious funding of such initiatives by military research organizations and, in particular, the Defense Advanced Research Projects Agency (DARPA), which was created as a shock reaction to the launch of the first satellite by the Soviet Union.

The last and current surge in interest in AI occurred in the mid-1990s. In 1997, an IBM computer called Deep Blue became the first computer to defeat the world chess champion Garry Kasparov. In 2011, the Watson question and answer system of the same company defeated the permanent champions of recent years in the game Jeopardy!

Although this part of recent history is very similar to what happened 50 years ago, nevertheless, the development of artificial intelligence in the modern era takes place in fundamentally different conditions.

The complication of communication systems and the tasks to be solved requires a qualitatively new level of "intelligence" of software systems, such as protection against unauthorized access, information security of resources, protection against attacks, semantic analysis and search for information in networks, etc. On the other hand, the globalization of economic life raises competition to a fundamentally different level, where powerful enterprise and resource management systems, analytics and forecasting, as well as a radical increase in labor efficiency are required. The third stage after the "winter" is also characterized by the presence of the largest open source of personal data and clickstream in the form of the Internet and social networks. And, finally, the key historical stop factor of the development of artificial intelligence is disappearing - the most powerful computing systems that can now be built both on cheap server capacities and in the largest cloud platforms in the pay-as-you-go mode [5].

All this justifies the optimism of the people involved about the third phase of artificial intelligence growth. The pessimism of some experts regarding the fact that the field's research direction is being overblown again is easily countered by the fact that now the researchers' developments have gone far beyond laboratories and prototypes and continue to intensively penetrate into almost all spheres of human life, from autonomous lawn mowers and vacuum cleaners equipped with a huge number of modern sensors, and ending with smart and learning mobile assistants, which are used by hundreds of millions of people [6].

Machine learning is one of the directions of artificial intelligence. The basic principle is that machines receive data and "learn" from it. Currently, it is the most promising business tool based on artificial intelligence.

Machine learning is a comprehensive application of statistics to find patterns in data and create the necessary forecasts based on them. Machine learning uses algorithms that allow a computer to draw conclusions based on available data [7]. Machine learning assumes that instead of creating programs manually withusing a special set of commands to perform a certain task, the machine is trained using a large amount of data and algorithms that give it the opportunity to learn how to perform this task independently or with the help of a so-called "teacher" (examples, training data) (Fig. 1.).

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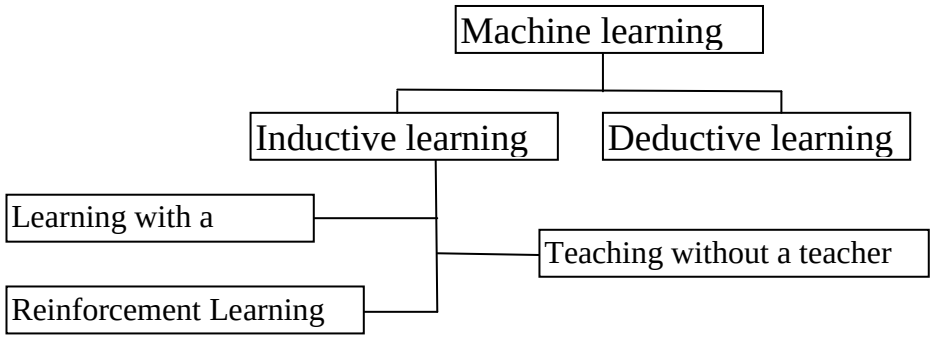

Fig. 1. Types of machine learning

Deep learning is a subset of machine learning. It uses some machine learning techniques to solve real-world problems using neural networks that can simulate human decision-making.

Until recently, AI scientists avoided neural networks, although they have been known for a long time. Even the most basic neural networks required very powerful calculations. However, in the mid-2000s, it became possible to demonstrate the principles of multilayered "deep learning" in practice, taking into account the available computer resources. The term itself gained popularity after the publication of Jeffrey Hinton and Ruslan Salakhutdinov, in which they showed that it is possible to effectively pre-train a multi-layer neural network if you train each layer separately, and then retrain using the method of error back propagation.

The breakthrough became possible when it became possible to make neural networks gigantic in size by increasing the number of layers and neurons. This allowed a huge amount of data to be passed through them to train the system, and the same depth was added to the training [8, 9].

In the last few years, there has been an explosion of interest in neural networks, which are successfully used in a variety of fields - business, medicine, engineering, geology, physics. Neural networks have come into practice wherever it is necessary to solve forecasting, classification or management problems. Such an impressive success is determined by several reasons.

Neural networks are attractive from an intuitive point of view, because they are based on a primitive biological model of nervous systems. As we have already noted, neural networks arose from research in the field of artificial intelligence, namely from attempts to reproduce the ability of biological nervous systems to learn and correct mistakes by modeling the low-level structure of the brain. The signaling system of a biological neural network, based on the intensity of the signal received by the neuron (and, consequently, the possibility of its activation), strongly depends on the activity of synapses [8].

Thus, being constructed from a very large number of very simple elements (each of which takes a weighted sum of input signals and, if the total input exceeds a certain level, transmits a binary signal further), the brain is able to solve extremely complex tasks.

An artificial neural network (INS) is a mathematical model, as well as its software or hardware implementation, built on the principle of organization and functioning of biological neural networks - networks of nerve cells of a living organism [9].

After the development of learning algorithms, the resulting models began to be used for practical purposes.

- Agriculture. Artificial intelligence is used to control the condition of plants, the level of

humidity, the presence of necessary nutrients in the soil and, in principle, for proper care of plantings. For example, robots have learned to identify weeds and carefully get rid of them (pulling them out or treating them with chemicals). Smart assistants are able to identify diseases of plants or pests that have attacked them from photographs, as well as deliver the necessary drugs point-by-point. This helps to use pesticides and herbicides more economically.

- Industry. In industry, artificial intelligence makes it possible to make work more and more automated, to the point that human participation is practically no longer required. In particular, LG plans to open a factory in 2023, where all processes - from the purchase of consumables to the control of products and their shipment - will be carried out with the help of artificial intelligence. The AI will also monitor the wear and tear of equipment, the fulfillment of set plans and other factors that a person usually monitors.
- Medicine. Here, smart assistants not only give advice to doctors, but also determine a predisposition to diseases or identify them at very early stages, when they can hide from the human eye.
- Security. The work of the police and firefighters already involves the use of artificial intelligence. The cameras installed in London not only record the fact of the crime, but also independently prepare documents for sending to the prosecutor's office.
- Home appliances. The "smart" house regulates the temperature in the room, launches the necessary equipment and performs dozens more useful functions.
- Education. The use of artificial intelligence in this industry makes it possible to automate the verification of tests, as well as to develop advanced methods of knowledge transfer.
- Banking and finance. Machine technologies detect fraudulent transactions and recognize questionable algorithms.
- Personnel management. AI is already being used to process resumes, conduct interviews, and monitor employee actions to prevent fraud.
- Marketing. The use of artificial intelligence allows you to collect and quickly analyze information about thousands of users to promote products and services.

Today, deep learning systems, such as deep neural networks, convolutional neural networks, deep trust networks and recurrent neural networks, underlie the services of many technology giants.

Since the field of machine learning is a fusion of mathematical sciences and programming, in Uzbekistan, which has a solid base and schools in these areas, there are good chances of obtaining the status of a global player with sufficient attention to this area from primarily relevant government departments in the form of programs and, of course, large private players.

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