PHILOSOPHY OF THE ARTIFICIAL WORLD

Electronic Culture: Problems and Prospects

ARTIFICIAL INTELLIGENCE IS THE CLUE TO THE FUTURE?[**]

YU.YU. PETRUNIN
Lomonosov Moscow State University, Moscow, Russia

DOI: 10.30727/0235-1188-2018-4-96-113-en
Original research paper

Summary

The article analyses the history and prospects of artificial intelligence as a scientific discipline and technology. Is it possible to reduce all intelligent human actions to an algorithmic procedure and how to find the meta-procedure for specific algorithms? To a first approximation, the answer to these questions might be the history of artificial intelligence. This history moves in cycles: it seems sometimes that very soon artificial intelligence will solve all the problems of the mankind, but then that artificial intelligence is only a utopia. Today we have serious reasons to believe that in the near future artificial intelligence can truly transform the human society. The main reason for new capabilities of artificial intelligence is possible integration of its applications with modern digital technology, Internet technology and Big Data. Possible social and existential threats associated with the artificial intelligence are discussed in the text. The article emphasizes that the positive use of artificial intelligence methods is directly related to our understanding of what a man

[**] The article is prepared as a part of the project of the Russian Foundation for Basic Research (RFBR) "The Russian Model of the Knowledge Economy and the System of Professional Training of Personnel: The Organizational and Economic Foundations of Innovative Transformations," grant no. 17-02-00059.

is. Thus, in the implementation of artificial intelligence technologies development participation of philosophy becomes vital.

Keywords: artificial intelligence, algorithm, meta-algorithm, expert systems, artificial neural network, philosophy, scientific and technological revolution, future.

Yuri Yu. Petrunin – D.Sc. in Philosophy, Professor, Head of the Department of Mathematical Methods and Information Technology in Management, School of Public Administration, Lomonosov Moscow State University; Co-Chairman of the Organizing Committee of Seminar *NeuroPhilosophy*, Chairman of the Organizing Committee of Seminar *Knowledge Management*.

E-mail: petrunin@spa.msu.ru

https://orcid.org/0000-0003-4218-2255

Citation: Petrunin Yu.Yu. (2018) Artificial Intelligence: Is It the Clue to the Future? // *Russian Journal of Philosophical Sciences = Filosofskie nauki.* 2018. No. 4, pp. 96–113.

DOI: 10.30727/0235-1188-2018-4-96-113-en

At the beginning of June 2017, Russian President Vladimir Putin spoke at the St. Petersburg International Economic Forum with a keynote address on how the future of our country is seen and what needs to be done to achieve it. Grandiose plans for the transformation of Russia included words and phrases that had hardly been met before in the speeches of the Russian leader: the digital economy, Big Data, neurotechnology, artificial intelligence. In the summer of the same year, the government program "Digital Economy of the Russian Federation" was adopted, in which these terms were already fixed as the main guidelines for the development of our country [Program "Digital Economy of the Russian Federation" 2017]. On September 1 of the same year in Yaroslavl, the President expressed even more clearly: "Artificial intelligence is the future not only of Russia, it is the future of all mankind ... the one who becomes the leader in this sphere will be the ruler of the world" [Putin 2017]. In

early October, Lomonosov Moscow State University hosted the All-Russian Science Festival. The largest audience was gathered by one of the Apple founders Steve Wozniak. What was he talking about? Of course, about artificial intelligence.

Russia, like the rest of the world, stands on the verge of epochal changes generated by the development of modern scientific theories and applied technologies. Of course, the term "artificial intelligence" is the key word for these theories and technologies. The term "artificial intelligence" has been known for a long time, but it was previously considered as a utopia of the distant future, and in everyday life it can be found in products that make our world a bit more comfortable: robots for cleaning dust in the apartment, smart gadgets, and intelligent Internet services. Unexpectedly, the future turned out to be much closer than expected. What really represents the "golden key" to this new world, the key that is called "artificial intelligence"? What beautiful new world can it open to humanity? Finally, when and how will this happen?

A large number of books and articles – from scientific to newspaper – have been written about artificial intelligence, a huge number of movies – from the cult "Terminator" and "Matrix" to series – have been made. They are discussed, they are talked about, they are disputed at conferences, in student audiences, in kitchens, and more recently in public authorities. I'll try to give my vision of the problem, taking into account the most important ideas, theories, approaches and results that have already been achieved. As Isaac Newton said, and after him the Google search engine, I will try to explain what is happening, "standing on the shoulders of Giants."

Let us recall the well-known legend about the "king of mathematicians" Carl Friedrich Gauss. He was a child prodigy and astonished everyone with his remarkable abilities. Once a teacher set a task of increased complexity: calculate the sum of all numbers from 1 to 100. The task was unusual and was not described in textbooks. Moreover, the school – neither in the 19th century, nor in the 21st century – does

not have the goal to teach to solve such problems. The schoolchildren who received the task carefully added one hundred numbers. Even on a modern calculator it is not easy: firstly, it takes a lot of time and there is a high risk of making mistakes, and secondly, you can easily skip any of the hundred numbers and get the wrong result. And the face of only one student lighted up with a blissful smile. There was something not only to smile at, but like the ancient Archimedes also to shout: "Eureka!" The young man opened a simple, quick and reliable way to solve the task: to add the first and last numbers of the proposed sequence. He got 50 pairs of numbers, the sum of each of which is equal to 101. The total is 5050.

What is important the child prodigy did not just solve a difficult problem, he came up with a rule or an algorithm for solving any similar problem. If this algorithm is taught to other students, they easily, without straining, will be able to add all the numbers from 1 to 200, or all numbers from 1 to 1000, etc.

In fact, school education (and not only school) is reduced to the assimilation of such algorithms. A few adults remember (except for those who do their lessons with their children or grandchildren) that all of us were once taught how to add single-digit numbers with passing through a dozen, how to add two-digit numbers, how to subtract two-digit numbers, how to determine whether the given number is divided by 5 or 3, etc. Therefore, all who graduated from the most ordinary middle school can count much faster than even the students of famous Archimedes.

In the learning process, not only algorithms associated with mathematical actions are formed. For example, there is a puzzle of passing labyrinth of rooms, without going through any room twice. In some rooms there is an even number of doors, in others – an odd number. You can go through each door only once. If the number of rooms in the labyrinth is small, then you can go all the way without any algorithms. However, when the number of rooms increases, the solution of the problem becomes more complicated. It is necessary

to think and find the algorithm which room to start from (even or odd number of doors for it) and how to move on. When you find an algorithm, or you learn it from someone, your decision will turn from an agonizing unsystematic search into a formal quick sequence of actions.

Any activity is related to algorithms. But algorithms are not only related to human actions. They can be easily found in the wildlife. Any organism tends to adapt to the external environment, receiving information about it through its sensory organs and influencing its body with the received information – this is the main task for the nervous system. If the nervous system does not solve this problem the body will not survive. "To solve such a problem, there must exist an algorithm," writes a well-known expert in the field of artificial intelligence Zhdanov. "The existence of such an algorithm and its uniqueness is evidenced by the quite definite similarity in the structure and functioning of the nervous systems of all living organisms" [Zhdanov 2012, 9].

A logical question arises: is there an algorithm with which you can solve any problem? Or at least a finite set of such algorithms? In short, the certainty that such an algorithm exists is the key idea of artificial intelligence. The second idea is that by opening such an algorithm we can model it, that is, implement it in a completely different medium (substance). Therefore, the book, which can be safely called pioneer in the field of artificial intelligence, is a book by Norbert Wiener "Cybernetics" [Wiener 1948]. Let us pay attention to the full title of this work: "Cybernetics, or control and communication in an animal and a machine." The term "artificial intelligence" is not presented there yet, it appeared only in 1956, but the main idea – the universality of algorithms for solving any problems including practical ones, regardless of their embodiment – is clearly discussed there.

"Principle of Universal Discovery" – so artistically accurately described the artificial intelligence the Swiss writer Friedrich Dürrenmatt (1962) in his play "Physicists" [Dürrenmatt 1962].

The next step in this direction was made by Alan Turing in his article "Computing Machinery and Intelligence" [Turing 1950]. The article of the British mathematician concludes his reflections on the "universal machine" (later called the "Turing machine") capable of performing the functions of any other machine, or in other words, calculating everything that can be calculated. The founder of computer technology von Neumann acknowledged that the concept of a modern computer is based on this work by Alan Turing. Turing machines are still the main objects of the theory of algorithms.

Finally, in 1956, the idea acquired a modern name: artificial intelligence. Neither Turing nor Wiener used this term. It was first proposed by John McCarthy, who created a special programming language for artificial intelligence problems – LISP. Without exaggeration, it is possible to designate the initial era of research in the field of artificial intelligence as an epoch of searching for a common algorithm for solving any problems ("the formula of all possible discoveries"). Algorithms that solve individual problems have already been discovered, for example, the algorithm for the mechanical proof of theorems. In 1959, Herbert Simon, Clifford Shaw and Allen Newell created the computer program called Universal Problem Solver (G.P.S.). The program was intended to solve several unlike tasks: proof of Euclidean geometry theorems and predicate logic, chess problems, the Hanoi towers puzzle. However, the program could not cope with many other real problems, since the search for a decision chain led to a combinatorial explosion of the intermediate steps number.

Attempts to borrow algorithms from specialists in different fields of knowledge have led to the emergence of so-called expert systems – complex software systems that simulate the explicit and implicit knowledge of professionals in a specific subject area. For example, Dendral is the first expert system in the field of organic compounds identification by means of a mass spectrogram analysis. The user entered some information about the substance and data

of spectrometry (infrared, nuclear magnetic resonance and mass spectrometry) into the Dendral system, and it in turn produced the result in the form of a corresponding chemical structure.

Another well-known expert system developed by experts in the field of artificial intelligence is Mycin. It was designed to diagnose bacteria that cause severe infections, such as bacteremia and meningitis, and to recommend the required amount of antibiotics depending on the patient's body weight. Testing the expert system Mycin has showed the effectiveness of the therapy it offered in almost 70% of cases, which is higher than that of infectious disease doctors.

Some clarifications are needed here. The first is understandable to people with humanitarian inclinations. The question is whether all problems can be reduced to algorithmic ones? Is there, for example, an algorithm for determining the correct accent in the words of a specific language? Or correct spelling? In French, for example, accent is always placed on the last syllable of the word. But in borrowed words, the accent can be in another part of the word. For example, in the word "computer" the accent will be on the second syllable from the end of the word, as in English. With other languages, for example Russian, the situation is even more difficult. The great Ludwig Wittgenstein is said to have studied Russian by Dostoevsky's novel Crime and Punishment. The book which belonged to Wittgenstein contained accents which he made with his own hand in all the words.

A more complex and important question is whether there is an algorithm for translating from one language to another. Since the Babylonian confusion of tongues, attempts to "restore the original language" (or "philosophical language") have not ceased. It was supposed that with its help it would be possible not only to learn all the wisdom of the world and accurately express it, but also to translate from any existing language into any other language. The history of this kind of attempts is full not only of philosophical and philological but also of artistic inventions and thought experiments:

from the satirical description of scholars dealing with this problem in Swift's famous "Gulliver's Travel," to the generative grammar of Noam Chomsky and the "Chinese room" of John Searle. Although the result of solving this problem is still not impressive, one cannot help but notice that modern machine translators undoubtedly translate better than a few years ago. In a word, there is some progress, but the universal algorithm has not been found yet.

Another clarification in the search for a universal algorithm is related to the nature of this algorithm. Let's return to the beginning of the article. A talented schoolboy discovered an algorithm for computing a sequence of numbers. We admire his abilities. But when other students start using it we can only note their diligence. The algorithm can simply be memorized. It is not about intelligence. The question is which algorithm should be searched for. The one with which you can solve a certain class of tasks, or a search algorithm that itself searches for / generates algorithms for solving any particular problem, and is a kind of meta-algorithm? Apparently, only the latter can be called intellectual.

Here is one example to illustrate this idea. I have had to attend mathematics Olympiads for elementary school recently. And I have made one unexpected observation. Those schoolchildren who regularly visit mathematical circles during the year can quickly cope with the tasks presented at the Olympiad. But does this mean that they are more talented, or to put it bluntly better know the algorithm for solving any mathematical problems? Unfortunately, it does not. Many newcomers, mastering on their own the algorithms for solving "typical" mathematical problems, over time catch up and outrun their peers who diligently visited their mathematical circles before. It turns out that circles and Olympiads do not develop that secret meta-algorithm (intellect!).

It is no exaggeration to say that the real history of artificial intelligence is an attempt to create (open) meta-algorithms that can find algorithms for solving any particular problem. On this way, really

promising tools of artificial intelligence have been proposed: models of neural networks, genetic and, more broadly, evolutionary algorithms, fuzzy logic, multi-agent systems, reflexive control, etc.

Quasi-artificial intelligence, as it can be called, has already defeated a person in many complex games; it recognizes road signs quickly and better and proves mathematical theorems, etc. But it is just an ordinary computer that has succeeded in competing with a person only at the expense of the computation speed, the search of options for possible solutions, the amount of memory and other not quite intellectual abilities.

But progress is also observed in the field of "real" artificial intelligence, that is, in the realm of an intelligent, meta-algorithmic search for the solution of any problem. Using the models and mechanisms of real artificial intelligence, the program solves problems that the person cannot solve with any known algorithm. This is really an independent, intellectual, creative activity, the results of which cannot be predicted. Perhaps a person generally uses other algorithms to solve this problem. And in advance one cannot say how the problem will be solved by artificial intelligence and whether it will be solved at all. In part, this process is similar to the training of people – no one knows in advance what will come out of the students. And no matter how much knowledge and what skills parents, teachers or experienced mentors invest in them, their students will not be the same as their teachers.

Let us summarize the results. Is it possible to reduce all intellectual human actions to an algorithmic procedure and how to find a meta-procedure for algorithms of specific problems? The answer to these questions is the history of artificial intelligence. It is a story that looks like a detective novel with an unpredictable end and therefore extremely entertaining. It is history, which involves not only mathematicians, but also philosophers, biologists, programmers, linguists and even writers and film directors.

It seems that this story is moving cyclically: at first everyone is sure that very soon artificial intelligence will make the lost humanity happy, after a while everyone thinks that artificial intelligence is just a utopia or a fruit of a sick imagination. I recall one interesting episode of this story. In the USSR, the artificial intelligence and cybernetics of N. Wiener were first criticised and considered insidious tricks of the bourgeois "decaying West," designed to get rid of the rebellious proletariat. Of course, it is convenient to deal not with obstinate employees who demand their legal rights to be respected, but with obedient, ready for everything robots. A few years later the attitude to the "cybernetic brain" in our country completely changed: cybernetics and artificial intelligence were announced to be other names for the expected communism. Recall at least book series created in the early 1960s with a stunning title: "Cybernetics in the service of communism." It is interesting to note that the changed Soviet approach was very disturbing for the US leadership, forcing government analysts to forecast serious threats to Americans [Gerovitch 2008].

Today, we face a new rise in expectations from the regularly resurrecting artificial intelligence. How should we feel about it? I believe that from the complex history of artificial intelligence several conclusions can be drawn.

The first conclusion. Is it possible to believe cheerful words and vigorous promises? I think that we have a good reason to believe a significant part of what is being said.

Why has the artificial intelligence been suffering for 60 years in laboratories and suffocating at fierce scientific seminars, thriving only in Steven Spielberg and Ridley Scott films and Arnold Schwarzenegger or Agent Smith heroes? Are not the new bold statements an illusion, a marketing move, "a form of madness"? [Katz 2012] Or as one opposition Russian newspaper wrote, the surge of attention to artificial intelligence is needed by the authorities in order

to "retouch the archaization of society, the profound and obvious for everyone stagnation of post-Soviet Russia."

I do not think that the excitement around artificial intelligence is only an instrument of political PR. If artificial intelligence is the pinnacle of evolution and not only biological, but intellectual, if we regard it as one of the kinds of creatures or mechanisms for processing information, then we can unequivocally assert that half a century ago it was "born" too early, completely alien to it unique abilities of the world. There are hypotheses that biological life has made several attempts on Earth to finally gain a foothold on the third planet of the solar system. Is not it the case with artificial intelligence?

Remember a very good expert system Mycin. The main reason why it was not used in practice despite the relatively good performance was the state of the system integration technology in the days of its creation. Mycin was an autonomous system that required the user to set all the necessary information, which took practitioner doctors significant time. Nowadays, such a system is integrated with the medical records system, extracts the answers to their questions from a patient database and is much less dependent on the information input by a doctor.

Over the past quarter century, the world has changed dramatically: everywhere we are surrounded by the ubiquitous Internet, mobile communications, social networks, virtual augmented reality, countless gadgets, Big Data, smart cars, smart home, smart city ... Every time, buying a new washing machine, a TV, a car, you admire the progress in the development of a seemingly familiar device autonomy, you admire the ever-increasing transfer of control to the car. This is an environment that is worthy of artificial intelligence – the domain of gadgets, telecommunications networks, large machine-readable data, the Internet of things. In this world, artificial intelligence feels itself in a friendly environment.

The past years have not gone in vain for the development of artificial intelligence theory. For example, let's take the evolution

of neural networks, which have now come to the fore in the rapid development of the intellectual capabilities of machines and technologies. Initially, in the late 1950s and early 1960s, it was believed that perceptrons – as the main child of neural network technologies were then called – would be able to solve any problems. After the publication of the book by Marvin Minsky and Seymour Papert "Perceptrons" in 1969 it seemed that the history of neural networks was over. But already in the enlarged edition of the book almost twenty years later it was shown that critical remarks due to new approaches are completely surmountable. Finally, more recently, the so-called deep neural networks (or artificial neural networks with deep training) have made a new breakthrough in the capabilities of the long-known technology. "It seems to me," says Konstantin Vorontsov (the Head of the Machine Intelligence Laboratory of Moscow Institute of Physics and Technology (MIPT), the Head of the Intelligent Systems Department of the Institute of Information Sciences of the Russian Academy of Sciences) "that there will be no more falls, and further progress of the neural networks will be progressive. Completed breakthroughs can no longer be ignored even by the most convinced sceptics" [Vorontsov 2017].

The second conclusion must necessarily correct the first conclusion: we should not wait for a miracle. The past of artificial intelligence teaches us not to be deluded soberly thinking about the future. The future comes secretly, even a revolutionary future. Witnesses' memoirs of at first almost imperceptible social changes can show us that the signs of tectonic transformations can be discovered only after a certain time. The same thing is true for technology: waking up we do not suddenly see an entirely new reality surrounding us.

Brilliant headlines, such as "Robots will drive officials and tax officials. Digitalization will reduce a third of officials in six years" [Orekhin 2017] can cause only a smile. But A.L. Kudrin the main shadow strategist of Russia's development is quite right saying that the third of professions will die out in the next 10 years. The only

question is whether changing the name of the profession means the disappearance of the profession. It seems that in many cases it is more correct to talk about the transformation of the profession.

What is real in the near future? We will highlight only some of the most probable events:

1. Creation and gradual distribution of autonomous cars. It is estimated that in the US alone unmanned vehicles will save more than $ 190 billion a year by reducing material damage from accidents [Ramsey 2015]. This can lead to consequences that today are even hard to imagine, for example, a ban for people to drive, the disappearance of the "personal car" concept, and the disappearance of the "vehicle driver" profession. The possibility of creating this miracle is based on the use of machine learning theories, neural networks and pattern recognition. But it would not have been possible without the development of global positioning systems and satellite navigation (for example, GPS), gyroscopic stabilizers and digital maps. Only relying on them artificial intelligence can reveal all its power.

2. Mass introduction of face and intentions recognition systems. There are different projects to scan not electronic cards, but the faces of incoming people in the subway or banks, [Loria 2016; Ovechkin 2017]. The solution of this problem also becomes possible on the basis of modern processing of visual information with the help of machine learning and deep neural networks. But it would have been impossible without creating huge dynamic data warehouses, optical high-resolution surveillance cameras, programs for working with Big Data and other results of "ordinary," not intelligent technology.

3. Creation of real smart search algorithms on the Internet in contrast to the modern "silly," not always effective, and obsessive search. It is not just about the search, which each of us can make, but also about finding us with intellectual (or not very intelligent) programs. For example: on my last birthday I received more congratulations by e-mail and SMS from robots (from Sberbank, various state services

portals and Internet services, shops and trade organizations, whose discount cards I have) than from people.

We can add that it's not just a search on the Internet, but in any large database. For example, in November 2017, the Prime Minister of the Russian Federation D.A. Medvedev proposed the concept of a new enforcement system in which artificial intelligence will be used. The latter will not only save legal texts from grammatical errors, but also be able to "independently generate court decisions on typical cases..." and "check court decisions for errors and corruption component" [Viskalin 2017]. The transition from the old, "human" system to the new, "robotic" system is planned in three stages. Once upon a time in the 6th century AD the commission of the Emperor Justinian codified the whole system of half-thousand-year Roman law in three years. Commission Count M.M. Speransky at the beginning of the 19th century ordered the three-century Russian legislation in almost 20 years. How long will it take to "clean" several decades of Russian rulemaking with the help of artificial intelligence? Scary to think! ☺

4. Development of truly clever helpers who do not annoy people, but are able to learn, adjust to the mood of the owner and control the environment around us – from the air conditioner to the smart apartment, to serve as an interlocutor and consultant at the same time. The things that we can see in science fiction are still far from what can happen in the near future. But the progress in this direction already exists.

5. Changes in education, with their advantages and disadvantages. According to some experts in the near future, intelligent robots will be able to replace teachers in schools [Teachers of the Future 2017]. I think that it will be more likely a significant change in the teacher's work, which has already begun. It changes not only the profession of the teacher, but also the "profession" of the student. Electronic diaries, school computer services, webinars for teaching children, and the Internet Olympics are becoming usual. These are,

of course, pluses. But there are also disadvantages: problems with vision of teachers and what is more important of children, inability and unwillingness to read, functional illiteracy, lack of skills in arithmetic and lack of communication skills, the inability of students to communicate despite the fact that they live in the era of the information society. The world is changing, and the person must inevitably change. Artificial intelligence becomes smarter; the human intellect becomes simpler and more primitive. Like any human muscle deprived of work the intellect can die like an unnecessary function for life. How should education be rebuilt and not just school to liberate the intellectual energy of a man, to direct it to creativity, to self-development of the individual, to create public goods? There is no clear answer to this question yet [Kudina, Logunova, Petrunin 2017; Tulchinsky 2017].

Likewise there is no answer to some other non-secondary questions, which philosophers and futurologists have long talked about: will people be able to cope with the changes caused by them? How will they change?

The third conclusion from the lessons of the past is connected with these questions: the future depends on people. How to change the world for the better? How to avoid the political, economic, social, and existential threats associated with the revolution of artificial intelligence? Strangely enough, but in the era of modern technologies of artificial intelligence the nearest future depends first of all on the humanities: philosophers, sociologists, and culturologists. Let's pay attention to the most expected changes, which were mentioned above. Most of them are associated with ethics. Indeed, how should the robot driver behave in a dangerous situation related to health and even people's lives? The well-known three laws of robotics by Isaac Asimov from his book "I, robot" [Asimov 1950] acquire a frightening acuteness in such a situation. The same problem emerges with the human face recognition with the help of computer vision. What if a person does not want to be watched? Does he/she have right to this?

Certainly he/she has. Again ethics! It is not by chance that in November 2017 the section "Ethical problems of artificial intelligence" was created in the Scientific Council (of the Russian Academy of Sciences) on the methodology of artificial intelligence and cognitive research. I think this section has a lot of work ahead of it.

What can a person with a humanitarian education do in such a high-tech science-intensive technical sphere as artificial intelligence? My experience of dealing with a business that is trying to exploit the wonders of artificial intelligence in everyday life shows that problems do not exist in the natural science or engineering tools, but in the humanitarian one. There is a huge amount of carefully worked out mathematical and software-implemented tools of artificial intelligence. There is a desire to relieve people's life with their help. The question is what a person really needs. For example, there is a goal to create a smart home assistant, integrated with home technology and able to learn to communicate with a specific person (the owner). To do this, the robot reads his owner's pulse, body temperature, etc., and on the basis of communication / training it discerns his/her secret desires, chooses lighting in the apartment, calming or invigorating music, and optimal humidity of the air. But in order to relieve stress which is the main disease of the modern civilization there are much cheaper, more powerful, and simple means, from medicine to banal alcohol. What makes machine learning based on advanced neural networks better in this situation? It is more expensive – that is for sure.

In a word, the positive use of artificial intelligence methods is directly related to our understanding of what a person is. What does a person need? What does he/she really need? Where are the limits of his/her "boundless" possibilities? To answer these questions, you need a humanitarian way of thinking, culture in the broadest sense of the word. Artificial intelligence as an idea has never been deprived of the attention of philosophy and humanitarian knowledge in general. Today, their participation in the fulfilment of the

humanity cherished idea is especially important. Otherwise, the key of artificial intelligence will open the door to the future, but behind the door we can see something that we do not like at all.

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