ARTIFICIAL INTELLIGENCE – TODAY AND TOMORROW

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Artificial intelligence exists and actively enters into our reality. We investigated this component of our life, examined the question of what artificial intelligence is, the history of its invention, the principles of its operation and its application in various areas of life, in particular, on public transport. Such components of artificial intelligence as machine learning, deep learning, neural network, cognitive computations and computer vision are revealed. The main question is: how can you make the movement of people over land, water and air more comfortable and safe using artificial intelligence technologies? At the moment, artificial intelligence is being successfully implemented in almost all types of transport: cars, buses, trams, metro, railway transport, airplanes, drones and ships. Companies around the world are working on new models of unmanned vehicles. Tests are conducted both in Russia and abroad. Countries seek to use the power of artificial intelligence as much as possible, creating whole smart cities with intelligent transport systems. There are new applications for land transport passengers and ridesharing fans. Such attention to the field of artificial intelligence due to such advantages of its use, as the absence of traffic jams and accidents on the roads, increased comfort of movement.

Artificial Intelligence (AI) is a concept that combines processes aimed at creating machines with intelligence, with the result that these machines can imitate human thinking. The main task of AI is to develop the functions of machines that are characteristic of human intelligence, such as learning, self-improvement and the ability to reason. That is, the main goal is not the automation of manual labor, but the execution of many large-scale computerized tasks.

The science of artificial intelligence is based on a number of disciplines: computer science, biology, psychology, linguistics, mathematics and engineering. Intellectual system – a system that can solve creative problems from a specific subject area. Knowledge of this area is stored in system memory. Another definition: it is an automated system based on knowledge, or a complex of software, linguistic and logical-mathematical tools for the implementation of the main task – the implementation of support for human activities and information retrieval in the advanced dialogue mode in natural language [2, p. 7].

Machine learning

Machine learning is a process in which machines learn and improve on the basis of experience. This process does not need to be programmed specifically for each action. Advanced technologies use algorithms that find patterns and generate ideas from data in order to make predictions and decisions in the future.

Also machine learning is:

1. the way to solve practical problems.

2. a way to increase the efficiency of computers.

Machine learning is used in health care, pharmaceuticals, diagnosis of diseases, rapid development of drugs, as well as in manufacturing and logistics. For example, Rethink Robotics uses machine learning to train manipulators and increase production speed. And in JaybridgeRobotics automate industrial-grade industrial vehicles for more efficient operation.

Deep learning

Deep learning is a machine learning method that uses artificial neural networks that learn by processing data. Such neural networks mimic biological neural networks in the human brain.

Several layers of artificial neural networks work together to find a way out of a variety of input data. (For example, see that the mosaic is folded into a picture).

For learning neural networks, including deep ones, the error backpropagation algorithm is used. In a deep neural network with several hidden layers, an error is calculated, which is transmitted from one layer to another. At the first stage, the error value is calculated at the output of the neural network, for which we know the correct answers. Then an error is calculated at the entrance to the output network layer, which will be used as an error at the output of the hidden layer. The calculation continues until the error is known on the input layer. That is why this algorithm is called an error backpropagation algorithm. [4, p. 31].

Thus, machines learn through positive and negative applications during problem solving. Self-study is the most advanced area of AI, thanks to which machines can make decisions, learn and think like people.

Neural networks

Deep learning is possible thanks to neural networks. Neural networks are computer systems modeled like neural connections in the

human brain. The artificial equivalent of a human neuron is the perceptron. Just as bundles of neurons create neural networks in the brain, perceptrons create artificial neural networks in computer systems.

Neural networks learn by processing examples. The best examples of training are presented in the form of large data sets, such as, for example, a set of 1000 photographs of cats. By processing multiple images (input data), the machine is capable of producing one output signal, answering the question "Is the image a cat or not?"

It is possible to characterize neural networks by the types of neurons used in the network, the structure of the network model, the methods of training the network and the tasks that the network solves.

According to the structure of connections, neural networks are [5, p. 2]:

1. Full-connected neural networks in which each neuron transmits its output signal to the rest of the neurons, including itself. All input signals are given to all neurons. The output signals of the network can be all or some of the output signals of neurons after several cycles of network operation.

2. Incomplete neural networks (usually called perceptrons) are divided into single-layer (simplest perceptrons) and multilayered, with direct, cross-sectional and feedback connections.

Cognitive computing

Cognitive computing is another important component of AI. His goal is to make the interaction between people and machines more productive. Cognitive calculations recreate the human thought process in a computer model. Estimation of mood is one of the main tasks of cognitive computations, since in order to fully understand the context and nuances of the human language, it is necessary to process words in their deepest linguistic meaning. Does cognitive computing have something in common with AI? They are similar, but artificial intelligence does not imitate human thought processes. AI provides the best algorithms for solving a particular problem. Cognitive calculations do not make decisions for people, but rather complement them.

Due to certain behavior and the ability to process information, cognitive calculations along with AI make the machine look like a person.

Natural Language Processing (NLP)

Natural language processing allows computers to interpret, recognize and reproduce human language and speech. The ultimate goal of NLP is to ensure uninterrupted interaction with the machines that we use every day. With the help of NLP, they learn to understand human language in context and to respond correctly to commands.

As an example – Skype Translator, which interprets speech in several languages in real time.

Computer Vision

Computer vision is a method that recognizes patterns for interpreting image content, including graphs, tables, PDF documents, as well as text and video. Thanks to this method is carried out deep learning. And machines can identify, process and interpret visual data.

There are many examples of using computer vision. For example, Tesla cars: they depend on a large number of cameras and on the sonar, which does not allow the car to stray from the route, and also fixes objects and vehicles around. Depending on innovation, computer vision helps in diagnosing, analyzing X-rays, MRI, CT and mammography, since almost 90 % of all medical data is based on images.

The history of AI

During the Second World War, the famous British scientist Alan Turing worked on hacking the Enigma code, which German forces used to send secret messages. Turing and his team invented the Bombe machine, which was used to decipher Enigma messages. The Enigma and Bombe machines laid the foundations for machine learning.

In 1950, Alan Turing published an article "Computing Machines and Mind", where he described the essence of the test, which later became known as the "Turing Test". This test was to establish whether the machine is able to think like a human being. If a machine communicates with people, and they think that this is a living person, and not a machine, then it can be considered "thinking".

In 1952, Alan Lloyd Hodgkin and Andrew Huxley developed a mathematical model of the brain that demonstrated the generation and distribution of action potentials in neurons and other electrically excitable cells. For the discovery of the authors received the Nobel Prize. It was a great contribution to the development of medicine and physiology.

In the 50s, an American scientist, John McCarthy, known as the father of AI, developed the LISP programming language, which was a significant discovery for the further development of machine learning.

In 1956, McCarthy organized the Dartmouth Conference, where the term "artificial intelligence" was officially adopted. In America, there were research centers to study the potential of AI.

In the 1960s, scientists sought to develop algorithms for solving mathematical problems and geometric theorems. In the late 1960s, work began on vision learning, in robots they began to develop the ability to machine learning. In 1972, WABOT-1, the first thinking humanoid robot, was built in Japan.

AI Winters

Despite the fact that the study of AI was well funded for several decades, scientists faced difficulties in creating machines with intelligence. AI programs (for example, vision learning) were supposed to process a huge amount of data, but computers were not powerful enough for this. Governments and corporations began to doubt the success of such research.

Therefore, from the mid-1970s to the mid-1990s, scientists faced an acute shortage of funding. These years are known as AI Winters. The time span between 1974 and 1980 is "The First AI Winter". It ended with the emergence of expert systems that were quickly developed and implemented by corporations around the world. The second AI Winter lasted from 1987 to 1993.

New methods-new features

In the late 1990s, American corporations again became interested in AI. The Japanese government announced plans to develop a fifth-generation computer to promote machine learning. AI enthusiasts believed that cars would soon be able to negotiate, translate from different languages, recognize images and think like people. In 1997, IBM Deep Blue came forward thanks to its first computer, which defeated the current world chess champion Garry Kasparov.

AI funding dried up when the dot-com bubble burst in the early 2000s. Nevertheless, machine learning continued to develop, mainly due to the improvement of computer equipment. Corporations have successfully used methods of machine learning in various fields.

The growth of computing power in the field of AI allowed companies to store a huge amount of data. For the past 15 years, Amazon, Google, Baidu, and other companies have used AI for commercial purposes. Now machine learning is used by many online services that we work with every day.

Spheres and methods of use

AI in public transport.

And in megacities, and in small towns, public transport is an important part of people's lives. Passengers who frequently use buses, subways, trolley buses and trams would like their daily trips to be as comfortable and safe as possible. To achieve this goal, municipal transport services use artificial intelligence technology. They help regulate traffic flows, monitor bus routes and ensure comfortable transportation of passengers to their destinations.

Advantages of AI systems for public transport.

Today, AI helps automate and optimize different processes of transport systems. For example, analyzing data on traffic congestion, AI can make recommendations on changing the route, control traffic lights, reduce traffic jams, analyze passenger traffic and monitor the condition of vehicles.

Various companies are developing smart buses equipped with artificial intelligence systems. Such machines use modern equipment and software that provide increased comfort and safety for passengers.

Intelligent systems help:

1. improve passenger service
2. make travel safer
3. optimize routes
4. reduce the number of accidents and car breakdowns
5. monitor passenger traffic and monitor fleets for carriers

Another advantage of cars with artificial intelligence systems is that most often they are cars that run on electricity. And it is much better for the environment and ecology.

Autonomous vehicles.

According to the World Health Organization, more than 1 million people die in a car accident every year. Accidents often occur for reasons of inattention on the roads, speeding and lack of driving experience.

Cars equipped with artificial intelligence, differ from traditional cars with computer control. To date, a number of leading firms are working on creating an autopilot for the car. It is assumed that such an autopilot must be equipped with a set of special sensors. They control everything that happens within a radius of 4–5 meters from a moving car. In addition, a camera and a radar are installed in its front. On board there is a GPS module. Information from sensors is processed by a computer system that recreates the big picture, analyzes it and issues signals to drive vehicles. Modern management systems are capable of self-learning and as a result are constantly improving themselves. [12, p. 2].

Cars with AI can drive independently, choosing a route depending on road conditions, weather and time of day. Cars without a driver do not get tired and do not lose concentration. Manufacturers claim that they are safe for passengers.

Today, smart cars are developed, tested and tested in Russia, USA, Sweden and other countries.

In addition, there is autonomous underground transport. Autonomous metro trains that travel without drivers are used in Paris, Istanbul, Dubai and other cities. In Moscow, in the next five years, it is planned to launch trains without a driver on the Koltsevaya metro line.

Artificial intelligence is the experience of Russia.

Autonomous electric car Shuttle, designed for 12 passengers, was introduced in 2016. It was developed by the State Scientific Center of the Russian Federation NAMI with the support of Yandex and KAMAZ. The car is equipped with video surveillance cameras and various sensors and can independently navigate the route to the destination.

In 2019, Cognitive Technologies and PC Transport Systems plan to launch a streetcar in Moscow without a driver. The tram was designed according to the Vityaz-M model and equipped with an automatic control system. The driver will be in the cab, ready to take control of the vehicle in the event of a dangerous situation on the road.

Automated systems for smart buses

Along with the development of autonomous buses, various companies produce automated systems that help organize the efficient operation of intelligent vehicles.

For example, the Russian company Euromobile has developed an integrated IT system for public transport. He sends data about the location of buses in the park, recording on the video camera everything that happens inside and outside. The fuel and tire pressure monitoring systems collect information about the condition of the car and also send it to the server. Voice auto informer informs passengers about the stops. In case of emergency, the ERA-GLONASS system sends the location of the bus to the park.

Another Euromobile project is the Auto-Conductor automated system. It registers the number of passengers transported by bus. Video cameras installed inside the bus track how many people get on the bus and get out of it. Data is transmitted to the central control station.

Artificial intelligence in air traffic

Airline AI technologies help passengers choose their flight directions and tickets. Thanks to these technologies, people do not need to go to the airport to clarify something. The AI system (for example, chat bot) can independently answer questions.

Google uses AI technologies in the "Flights" service, designed to track and book air tickets. Special algorithms are able to predict flight delays before the airline reports them.

Aviation-Russian experience

S7 Airlines, a Russian airline, uses artificial intelligence technology to help passengers choose their tickets. In the Facebook Messenger application, a chat bot informs customers about flight status and available air tickets. In addition, he can even choose a city for travel based on key queries.

Aeroflot is going to use AI to predict ticket prices and demand for regional routes. Thus, the airline will be able to avoid losses when entering new markets.

Drones

The goal of the European Urban Mobility Commission is to introduce unmanned aerial vehicles – drones. This is necessary for the delivery of goods (and theoretically – passengers) to various institutions. UAV drones would be the solution to all problems arising in transportation due to the human factor. Vasilis Aguridas, leader of Urban Air Mobility, said: "Over all modes of transport, including aviation, which is the safest mode of transport, intensive work is underway to further improve security by eliminating errors due to human factors and using new technologies such as artificial intelligence, machine learning and advanced sensors".

Autonomous ships

AI has captured not only ground transportation: it is currently in the development of remote-controlled vessels, which Rolls-Royce plans to launch by 2020. The crew of such a vessel will be on land, which involves reducing the risk of harm to workers and more space on board for the transport of goods. The main problem faced by developers, as indicated in the official Rolls-Royce document, is the risk of software hacking and ship redirection.

AI for traffic monitoring

Today you do not need to freeze on the street, waiting for your bus or trolley. You can

use a mobile application or online service to find out when the desired transport will arrive at the bus stop.

For example, the Trafi app shows real-time public transport and routes to destinations in Madrid, Riga, Tallinn, Rio de Janeiro, São Paulo, Jakarta, Istanbul and other cities. The service works even without an internet connection.

The inhabitants of Saratov, Balashov and Engels have a transport service Smart. This is an interactive map showing public transport routes. The portal allows users to find out when the bus comes to a particular stop.

At the same time, tests of the "Transport 45" service began in the Kurgan Region. Passengers can choose a stop, plan a route and find out the schedule of long-distance trips. The application also allows you to monitor the movement of vehicles. Similar services are available in other cities of Russia.

Intelligent Transport System

The Intelligent Transport System is an intelligent system that helps regulate traffic flows. It aims to improve highway safety and improve public services.

Munich launched the transport management system in 1991. Intelligent transport systems also operate in other major cities: London, Bristol, Brussels, Lyon and Toulouse. They regulate car traffic in tunnels, on ring roads and on strategic sites; Help you control parking and choose routes to bypass RTA zones.

AI in China

The Chinese company Didi Chuxing is the world's largest ridesharing company ((English ride "trip" + English share "share") – joint trips by car, whose participants share expenses among themselves; they are looking for a car in online applications). Didi Chuxing strive to be the first in the world and make a revolutionary contribution to the field of transport and automotive. Company President Jean Liu focuses on the globalization of a $ 56 billion conglomerate. In China, the company has 550 million registered customers in more than 400 cities and makes 30 million trips per day, but within the framework of partnerships it covers Australia, Brazil, Japan and Mexico, as well as Southeast Asia, India, Europe and Africa.

Didi Chuxing makes a huge investment in AI technology.

Working daily with a huge amount of data, Didi occupied an important place in this business: they have the opportunity to optimize navigation routes using AI technology. The company launched Didi Smart Transporta-tion Brain, which combines data from Didi car cameras and sensors with data from the government and other partners. The company's goal is to create a system of management of urban traffic based on artificial intelligence and cloud technologies. Ultimately, this should lead to the creation of smart traffic lights and monitoring systems that can be used in any metropolis with traffic congestion.

Didi also use augmented reality applications that help passengers get to the location of the vehicle. The cars use a digital assistant that is activated by voice and offers a wide range of services, including audio and video content, as well as places for refueling, charging and repair.

Smart rails.

High-speed rail, launched in the Chinzhou district of China in 2017, is a train that runs without rails. Instead, he uses pneumatic tires and rides on a special marking that paves the route. Sensors embedded in the train recognize this marking and force the train to move along it, as if on rails.

Trains that transport cargo and passengers using AI and machine learning have been tested in other countries.

Moscow-transport systems

Moscow has been using the transport system since 2011. She combined signal lights, detectors and surveillance cameras. Their data are sent to the Traffic Management Center. This information is used to make short-term and strategic forecasts and, therefore, to monitor the traffic situation.

Now the intelligent transport system is functioning in such a way that detectors and cameras help fix traffic jams. With this information, artificial intelligence determines how long a green or red light should shine.

Also, electronic displays are placed on urban highways. They show information about traffic jams, weather and estimated travel time to a certain place. Operators provide integrated intelligent system operation. They track cameras, inform police about traffic accidents and respond to driver requests.

Thanks to the integration of the intellectual transport system, according to the Moscow government, the average speed of traffic in the city increased by 12-13 %.

AI training in the field of transport and not only.

In 2018, a free educational system appeared in Finland, the purpose of which was to teach the basics of artificial intelligence to at least 1 % of the 5.5 million people in the country. Universities and enterprises wishing to improve the

qualifications of their employees support the AI Challenge, which was launched in 2017 as a free online course. It became popular because its creators worked to make AI training accessible to a wider audience. Finland intends to become a world leader in the practical application of AI and plans to establish partnerships with its neighbors, Estonia and Sweden, to conduct tests on the use of AI in transport, cross-border transportation and infrastructure.

Perspectives

Now artificial intelligence can easily cope with tasks that previously were only possible for man. Cars on autopilot can drive independently, choosing a route depending on road conditions, weather and time of day. Such cars do not get tired, do not lose concentration and do not go astray, which is why they are safe for passengers. Artificial intelligence helps to automate and optimize various processes of transport systems. Analyzing data on traffic congestion, intelligent transport systems can make recommendations for changing the route, control traffic lights, reduce traffic jams, analyze passenger traffic and monitor the condition of vehicles. Airline AI technologies help passengers choose their flight directions and tickets. In Europe, they are working to introduce special drones to deliver goods and passengers to various institutions. Remote controlled vessels are being developed that can operate without crew on board. All these achievements show that artificial intelligence has a great future. And, if you correctly use the full potential of AI, then we can make our life much more comfortable, safe and environmentally friendly.

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