CULTURAL SCIENCES

ROBOTICS AND ARTIFICIAL INTELLIGENCE IN THE DYNAMICS OF CONTEMPORARY CULTURE

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Abstract
The main trends and forecasts of robotics and artificial intelligence application in modern world are considered. The problem of human development in the competitive world of digital transformation is investigated: optimal combination and efficiency of application of scientific-technical, intellectual and industrial potentials; social consequences and global responsibility for safety of human existence

Keywords: robotics, artificial intelligence (AI), cobots, technology, augmented reality (AR), virtual reality (VR), Internet of Things (IoT), big data analysis

Periodisation and approaches to research

The topic of robotics and artificial intelligence (AI) has been the subject of much scientific work. A growing number of researchers and experts are predicting a fourth technological revolution. However, the debate between those who believe that technology will help solve social problems and those who see a threat to world order is still going on. Some of the ways to clarify the situation are: dissemination of knowledge about robotics and AI through publications, disclosure of research results in world and national science; explaining to the general public the social value of robotics and AI through the eyes of scientists; the application aspect of useful developments in the field to life.

There are four periods in the history of robotics and AI, combining several areas of research, where the problem is treated as a combined interdisciplinary perspective.

The first period (early 1980s) is the emergence of the field of AI in Education (AIED) to enhance practical skills and improve student learning outcomes using computers, as well as to explore the potential of intelligent learning systems (Computer-Centred Collaborative Learning (CSCL), hypertext systems) [1; 2]. Approbation of learning methods - hypermedia, observational learning, self-explanation, enquiry [3; 4; 5].

The second period (early 1990s – 2000s) - practice of collaborative learning; interaction, self-regulation and motivation are the main concepts of collaborative learning [6; 7].

Third period (2000-2011) - introduction of interactive learning systems to adjust the learning process, e.g. Educational Data Mining (EDM) method, big data sets and extended relationships between them [8; 9].

The fourth period (2011 - 2017) is the formation of Learning Analytics (LA), which focuses on the research of complex learning processes and interdisciplinary combinations of computer science, educational psychology, engineering and pedagogy [10; 11].

The fifth period (2018s – 2023s) is the emergence of intelligent manufacturing, the use of collaborative (assistive) 'cobots', which, unlike robots, are designed to work with humans. At the same time, cobots are designed to do monotonous, dangerous or dirty work. They found their application during the covid-19 pandemic (reference bots, food delivery bots, etc.)

Scientific research on robotics and AI and various attempts to improve human intelligence and physical space have contributed to the emergence and perception of the concept of an extended society, i.e. a society in which human senses (sight, hearing, tactile senses) are controlled by technology, using information (collection, storage, processing) in the environment for analysis and decision-making based on AI.

A variety of technologies such as augmented reality (AR), virtual reality (VR), Internet of Things (IoT), AI and big data analysis are now actively used in manufacturing, medicine, management and education. This makes it possible to improve the efficiency of all social activities and the quality of human life.

Directions for robotics and AI

Development and implementation of digital technologies are increasingly directed not only at transforming the economic order, performing high-precision complex measurement processes and processing massive amounts of data. Man wants to endow machines with consciousness as well.

Can technology give AI consciousness? Such questions arise when humans interact with a social robot. As defined by C. Darling of the Massachusetts Institute of Technology, "a social robot is a physically embodied, autonomous agent that communicates and interacts with humans on a social level" [12].

Polish researcher M. Klitschowski hypothesizes that people copy the behaviour of a robot, which today communicates with people in natural language and recognizes their actions and emotions. Technology has become more intelligent and autonomous; it performs complex tasks, makes decisions (diagnoses, manages production, individualises learning). Although people do not like the opinions generated by algorithmic machines, the effectiveness of AI actions is generally rated quite highly [13].

The social robots Kismet, Aldebaran NAO and the humanoid robot Sophia are shown in Figure 1.

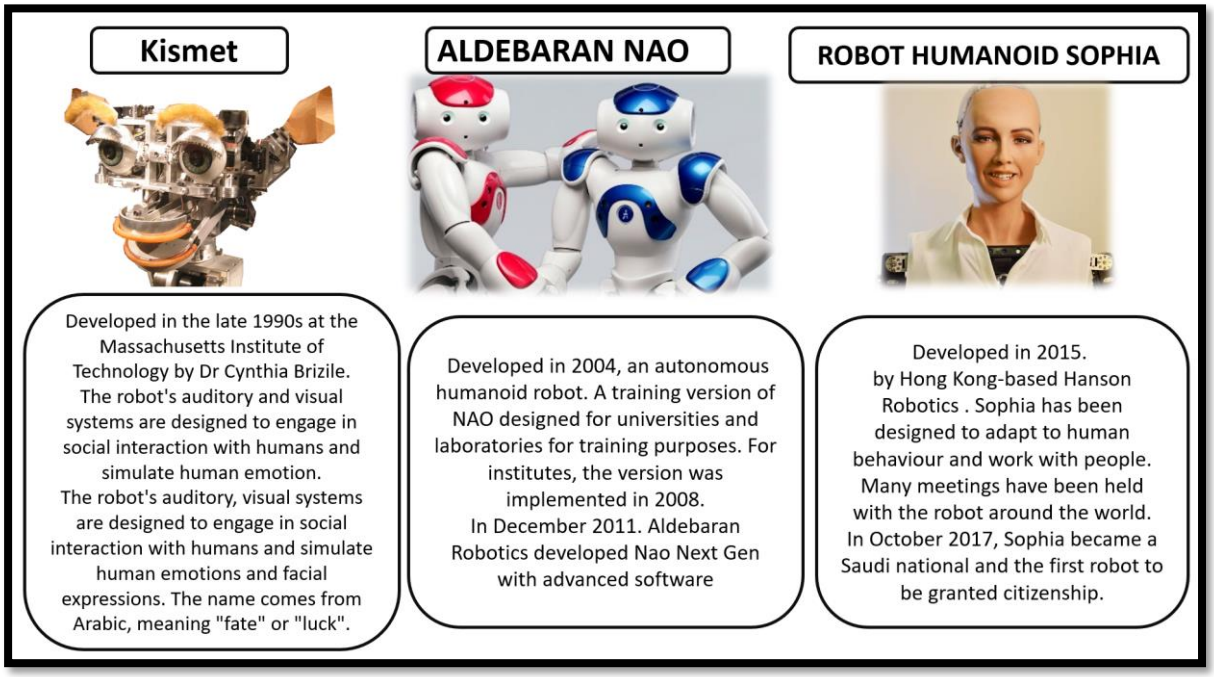

Figure 1. Examples of social robots

The use of robotics and AI in education is of particular interest. Lifelong learning or multi-context lifelong learning is a requirement of our times.

Researchers in the Department of Computer Science at the University of Georgia in the US, D. K. Mandivarapu, B. Camp and R. Estrada, believe that continuous learning is one of the most challenging tasks for AI. "Continuous learning is not a single problem, but a family of interrelated problems, each of which imposes a different set of constraints on the learning process (e.g., fixed architecture, lack of access to prior learning data, etc. [14].

Researchers believe that previously developed AI-based educational platforms (systems) used in continuous learning are imperfect. They are capable of performing one new task at a time; each task can be completed independently of other tasks; tasks have labels (i.e. the system knows which task to complete at any given time); the system does not have access to old learning data.

To promote lifelong learning, researchers have developed a new platform, Self-Net, which uses state-of-the-art autoencoders to facilitate lifelong learning through continuous auto-modelling. Their empirical results confirm that this method can effectively retrieve and store a large number of tasks on a continuous basis, retain old learning data and use it for re-learning; apply hidden space for exposition to new tasks, using little or no training data [14].

Certainly, this topic generates much controversy in society, with highly contradictory judgments. While some defend research and support useful developments and the introduction of technology into life, others foresee hidden dangers and paint tragic future scenarios for humanity.

For example, robotics and AI are already solving social problems through automation and energy sustainable production. Robotics and AI are involved in logistics, design and simulation of various construction, automotive, aviation, shipbuilding and space industries. Modern gadgets are an example of how sophisticated software helps in planning and organising work, learning and leisure.

New global problems of mankind give rise to new forms of solutions. The bet is again on technology. For example, the emergence of the COVID-19 virus in 2019 has facilitated the development of an AI-based tool that speeds up recruitment with contact information for emergency research for the virus [15]. Research in this area is ongoing.

Italian Professor J. Metta, who specialises in biomotivated and humanoid robotics (in particular in the development of humanoid robots that can adapt and learn from experience), believes that robotics and AI are "not just a revolution of implementing a new set of technologies; they are setting new rules, changing the game through influencing the human process and its 'evolution'" [16]. The researcher believes that robots will help maintain quality of life in the third and fourth ages.

Predictions for robotics and AI applications

There is no doubt that the social value of robotics and AI, the transformation of information technology into something "physical", and the possibility of raising the robot to a new level of autonomy and safety imply enormous opportunities.

Modern Japanese robots are successfully used in various fields: music (robot violinist), social sphere (robot social worker), sports (robot athlete), education (robot teacher), psychology (robot assistant), cooking (robot chef), etc. (Fig. 2) [17].

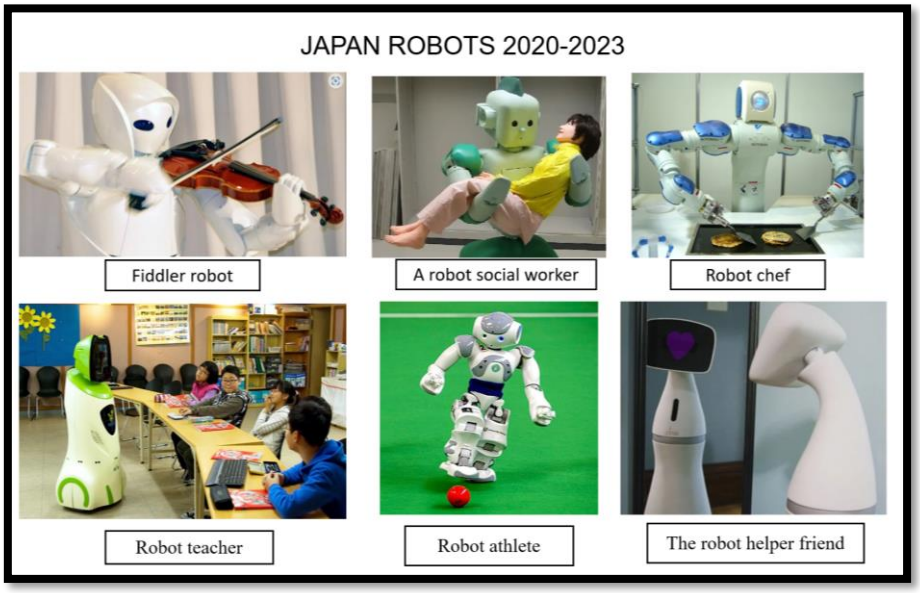

Figure 2. Japanese robots used in various applications

However, some analysts warn of the possibility of labour displacement and social dislocation. Although it is difficult to predict overall scenarios in the long term, European Commission representatives warn that by 2050 there will only be two productive workers (>16 years) for every person over working age (>65 years). About 29% of total GDP will be spent on social benefits - supporting pensions, healthcare and long-term care programmes for disabled and elderly people. People will see a reduction in the workforce rather than unemployment and a chronic inability to support people in need. In advanced economies and depressed areas of the planet (5/6 of the world's population), robotics and AI, together with streamlined manufacturing and low-cost production technologies, could be the ideal partnership policy for energy and health [18].

Another fear of the introduction of robotics and AI is the issue of human control and control over technology. These fears are expressed by Polish philosopher S.E. Lez: "Technology will reach such perfection that man can do without himself", British physicist S. Hawking: "The emergence of full-fledged AI could be the end of the human race... Human capabilities are limited by too slow an evolution, we will not be able to match the speed of machines and will lose. Machines will be smarter than humans", and American entrepreneur and Microsoft co-founder B. Gates: "In a few decades AI will become advanced enough to be a cause for concern". [19, c. 203-204].

Despite the pessimistic predictions, modern culture is already inseparable from technology. Scientific approach, research and discovery, publication of scientific results and their dissemination are the fundamental mission of scientists. Knowledge will contribute to the understanding of what we create, and its dissemination will avoid risks, justify future research science policy.

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