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APPLICATION OF MODERN COMPUTER TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE IN CHILDREN'S CARDIOLOGY

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Abstract
The article analyzes the importance of modern computer technologies and artificial intelligence (AI) systems in the field of pediatric cardiology, their role in medical diagnostics, treatment and prevention. The achievements of artificial intelligence in early detection of heart diseases, real-time monitoring of the patient's condition, creation of a heart model using "digital twin" technology are highlighted. The article compares and analyzes foreign and domestic experiences

Keywords: pediatric cardiology, computer technology, artificial intelligence, diagnostics, ECG, digital twin, heart defects, medical innovations.

Introduction

In recent years, the process of digitalization in medicine has been rapidly developing. Artificial intelligence, machine learning, "big data" technologies and digital medical systems are playing an important role in early detection of diseases and improving the quality of treatment. These technologies are especially vital in the field of pediatric cardiology, since cardiovascular diseases in children often remain hidden.According to the World Health Organization (WHO), more than 1 million children are born with congenital heart defects every year. More than half of them live with complications due to lack of early diagnosis. Therefore, the role of computer technologies and artificial intelligence in the early detection of children's heart diseases is increasingly increasing.

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Main part

1. The role of computer technologies in diagnostics

Digital medical systems have taken the monitoring and analysis of heart activity to a new level.

Digital electrocardiography (ECG) programs automatically record the heart rhythm and identify anomalies. Data is stored on cloud servers and exchanged between medical centers.

Echocardiography (ultrasound) allows the structure of the heart, blood flow, and valve function to be visualized in 3D format. An AI system developed by Chinese scientists automates this process and accurately measures the thickness of the heart wall and the volume of the chambers. As a result, the diagnostic speed has increased by 2 times (MDPI Children, 2022).

Remote heart monitoring has been established using telemedicine. The doctor monitors the patient's ECG data in real time, and if changes are detected, an automatic warning system is triggered.

2. The role of artificial intelligence in medical practice

Artificial intelligence not only analyzes data, but also helps the doctor in the forecasting and decision-making processes.

A model developed at the Mayo Clinic (USA) was able to detect heart muscle dysfunction in children at an early stage based on simple ECG results. The AI model gave a warning before the doctor even noticed clinical signs.

European scientists (BMC Pediatrics, 2024) analyzed heart images of more than 1,000 children and created an AI model that detected congenital heart defects with 90% accuracy. This system is also used for prenatal (prenatal) diagnosis, which allows detecting heart defects at the stage of fetal development.

Preliminary work in this direction has also begun in Uzbekistan. Specialists of the Tashkent Pediatric Medical Institute, in collaboration with TATU, are creating a neural network model that automatically detects changes in heart rhythm.

3. “Digital Twin” technology

In recent years, a new concept has emerged in pediatric cardiology - “Digital Twin” technology.

This technology creates a virtual model on a computer based on the patient's heart. The model analyzes blood flow, pressure, and heart contraction force. For example, if a child has a valve defect in his heart, the doctor “tests” the result of the operation

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on a digital model before surgery. As a result, the risk of complications is reduced, and the treatment strategy is clearly planned.

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Digital twin technology will become the basis for developing individual treatment programs for heart diseases in the future.

4. Problems and prospects

There are some problems with the widespread introduction of artificial intelligence in pediatric cardiology:

The database of ECG and MRI images is insufficient.

Since the physiology of the heart in children is different from that of adults, it is necessary to adapt the models.

It is important to ensure data confidentiality and adhere to ethical principles.

However, the prospects for this area are broad. In the coming years, it is expected that the level of early diagnosis of heart diseases in Uzbekistan will significantly increase with the help of systems developed based on AI.

Conclusion

Computer technologies and artificial intelligence have ushered in a new era in pediatric cardiology. With their help, it has become possible to detect heart diseases at an early stage, remotely monitor patients, create an individual treatment plan, and pre-test surgical procedures.

In the future, the introduction of these technologies in Uzbek medicine, training doctors in the use of AI systems, and expanding the medical database will take the quality of medicine to a new level.

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