



DIAGNOSIS AND TREATMENT OF CHILDHOOD ONCOLOGICAL DISEASES USING MODERN IT TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE

Atahanov Sanjarbek Anvarovich

Assistant, Department of Biomedical Engineering, Biophysics, and
Information Technologies

Fergana Institute of Public Health, Republic of Uzbekistan

Ravshanova Leila

1st Year Student, Faculty of Pediatrics

Fergana Institute of Public Health, Republic of Uzbekistan

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ABSTRACT

The article discusses modern approaches to diagnosing and treating childhood oncological diseases using the latest information technologies and artificial intelligence systems. It demonstrates how the use of machine learning, neural networks, big data analysis, and telemedicine helps improve diagnostic accuracy and treatment effectiveness. Particular attention is given to the ethical aspects of implementing digital technologies in pediatric oncology..

Introduction

Oncological diseases in children are among the most serious problems of modern medicine. Although childhood cancer occurs less frequently than in adults, it often develops rapidly and requires the most accurate and prompt diagnosis.

According to the World Health Organization, about 400,000 new cases of malignant tumors in children are recorded annually worldwide.

The main difficulty lies in the fact that the early stages of childhood oncological diseases often progress without symptoms. As a result, children are brought to specialists only at later stages of the disease, when treatment requires significant time and effort. Therefore, in recent years, more and more attention has been given to the use of information technologies (IT) and artificial intelligence (AI) in diagnosis and treatment.

Modern IT solutions make it possible to automate the processing of medical data, accelerate image analysis, and increase diagnostic accuracy. Artificial intelligence is capable of analyzing vast amounts of information and detecting patterns that are impossible to identify with the naked eye. This makes it an irreplaceable tool in pediatric oncology.

1. Modern Problems of Diagnosing Childhood Oncological Diseases

One of the main problems of pediatric oncology is late diagnosis. In the early stages, malignant tumors often show no clinical symptoms, and the few that do appear may resemble common infectious or inflammatory diseases. In addition, diagnosing children requires a special approach, as not all imaging methods are safe or permissible at an early age.

Limited diagnostic resources in small clinics and remote areas also complicate timely detection of tumors. Even when MRI or CT scans are available, interpreting results requires

high medical expertise. Under these conditions, IT technologies and artificial intelligence can greatly improve diagnostic quality through automated image and data analysis.

2. The Role of Information Technologies and Artificial Intelligence in Early Diagnosis

Modern information technologies allow large volumes of medical data to be stored and analyzed in electronic systems. Artificial intelligence, especially machine learning algorithms, can identify correlations between symptoms, test results, and imaging findings.

For example, neural networks trained on thousands of medical images can automatically identify pathological areas and classify tumor types. Such technologies are already being used in the diagnosis of leukemia, sarcomas, and brain tumors in children.

AI also helps predict disease progression and the likelihood of relapse, making treatment more personalized. Thus, AI serves as a reliable assistant to doctors, enhancing the quality of medical decision-making rather than replacing human professionals.

3. The Use of Neural Networks and Machine Learning in Medical Image Analysis

One of the most successful areas of AI application in medicine is image processing. Neural networks can analyze MRI, CT, X-ray, and ultrasound scans, identifying even the smallest signs of tumor development.

Thanks to deep learning, AI systems can distinguish tumor types, determine their size, and assess growth dynamics. This is particularly important for children, where early detection helps avoid aggressive treatment methods.

Additionally, neural networks can automatically compare results from different periods, helping doctors monitor treatment effectiveness. This reduces analysis time and minimizes diagnostic errors.

4. The Use of Digital Platforms and Telemedicine in Treatment

Modern digital platforms enable continuous monitoring of a child's condition. Patients and their parents can share information about well-being, test results, and medication intake via mobile applications.

Telemedicine ensures remote patient observation, which is especially important for families living far from large medical centers. Doctors can remotely evaluate a child's condition, adjust medication dosages, and prescribe additional tests.

Digital technologies also facilitate closer collaboration between specialists from different countries, improving the quality of diagnosis and treatment for complex pediatric cancer cases.

5. Ethical and Legal Aspects of AI Use in Pediatric Oncology

Despite enormous potential, the use of artificial intelligence in medicine raises a number of ethical questions. First and foremost is the protection of children's personal data. Medical information must be securely stored and used only with the consent of parents or legal guardians.

It is also important to maintain balance between technology and human involvement. Artificial intelligence cannot replace doctors, as it lacks intuition, empathy, and clinical reasoning. It must remain an auxiliary tool that helps physicians make more accurate decisions.

Furthermore, clear legal frameworks are needed to regulate responsibility for AI-related errors and to standardize certification of such technologies

Conclusion

The application of artificial intelligence and modern IT technologies in pediatric oncology opens new horizons for medicine. They improve diagnostic precision, accelerate decision-making, and make treatment more personalized and effective.

However, the introduction of AI requires a comprehensive approach that includes specialist training, ethical standards development, and data security assurance. Only through responsible and thoughtful implementation can these technologies bring maximum benefit to children suffering from oncological diseases.

Thus, digital medicine is not just a complement to traditional treatment methods but a key step toward a new era in pediatric oncology — an era where technology and human compassion work together to save children's lives.

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