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THE IMPORTANCE AND RELEVANCE OF ARTIFICIAL INTELLIGENCE IN THE DIAGNOSIS AND TREATMENT OF ONCOLOGICAL DISEASES

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Abstract This article analyzes the application of artificial intelligence (AI) and machine learning (ML) technologies in modern oncology, and their role in early diagnosis, treatment planning, and personalized medicine. The efficiency of processing radiological and histological images using AI algorithms, analyzing genomic data, and determining disease prognosis is examined. The findings indicate that AI technologies optimize the decision-making process of physicians and significantly increase the survival rates of oncological patients.

Keywords: Artificial intelligence (AI), oncology, machine learning, deep learning, radiomics, digital pathology, personalized medicine, targeted therapy.

INTRODUCTION

According to the World Health Organization (WHO), oncological diseases rank among the leading causes of death worldwide. The biological diversity of tumors, their susceptibility to molecular-genetic mutations, and the frequent detection of the disease in late stages complicate the treatment process.

In modern oncology, a massive volume of data (Big Data) is generated for each patient—clinical tests, tomography images, histological reports, and genetic passports. The human brain is incapable of comprehensively analyzing all this data in a short time. At this precise point, the introduction of Deep Learning and Artificial Intelligence (AI) systems based on neural networks has become highly relevant in medicine. The primary goal of AI in oncology is not to replace the doctor, but to serve as an analytical tool that helps them make the most accurate, rapid, and evidence-based decisions.

METHODS

This analytical article presents a comparative analysis of scientific research published over the last 5 years in leading global medical and bioinformatics journals (PubMed, Scopus, Web of Science databases), open clinical trial results, and data regarding the practical implementation of AI platforms (e.g., IBM Watson for Oncology, Google Health).

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RESULTS AND DISCUSSION

Artificial intelligence is bringing fundamental changes to various stages of oncology. These changes can be divided into 3 main areas:

Early Diagnosis and Radiomics

Early diagnosis is the primary key to successful cancer treatment. AI algorithms, particularly Convolutional Neural Networks (CNNs), are showing unprecedented results in image recognition.

- **In Radiology:** When analyzing Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and mammography images, AI can detect microscopic changes and differences in tissue density (radiomics) that the human eye cannot perceive. For instance, in detecting lung cancer or breast cancer in early stages, AI systems demonstrate an accuracy rate (95-97%) equal to, and sometimes higher than, that of experienced radiologists.
- **In Dermatology:** AI programs that analyze melanoma and other skin cancers based on simple dermatoscopic images are showing high efficiency in distinguishing pathology from benign conditions.

Digital Pathology and Histological Analysis

Examining histological sections and determining the malignancy grade of a tumor requires extensive experience from an oncomorphologist.

- Analyzing scanned histological slides (Whole Slide Imaging - WSI) using AI helps pathologists reduce the likelihood of errors.
- Algorithms automatically calculate cellular nuclear atypia, the number of mitotic figures, and the infiltration of tumor-infiltrating lymphocytes (TILs) around the tumor. This, in turn, minimizes the impact of the human factor when determining the prognosis of a carcinoma.

Personalized Treatment and Drug Discovery

Traditional chemotherapy is often administered to all patients based on the same standard (protocol). AI, however, paves the way for **Personalized medicine**.

- **Genomic Analysis:** By analyzing the specific set of genetic mutations in a patient, AI predicts which targeted drug or immunotherapy will yield the best results.
- **Predicting Disease Recurrence:** By summarizing the patient's clinical signs, test results, and response to treatment, AI calculates the risk of recurrence in advance.
- **Synthesis of New Molecules:** Developing a new oncological drug typically takes decades. Deep learning models like AlphaFold have modeled protein structures, accelerating the process of creating new potential drugs many times over.

How AI Predicts Disease Recurrence

Artificial intelligence (AI) utilizes **Predictive Analytics** and **Machine Learning** algorithms to forecast the recurrence of a disease, particularly cancer. This process is not "magic," but is based on finding logical threads within massive volumes of data that the human brain cannot perceive.

Let's look at how AI accomplishes this process step-by-step:

1. Gathering historical "experience" (Training phase) For AI to make predictions, it must first learn. To do this, the medical records of tens of thousands, sometimes millions, of previous patients are entered into the system. This database includes for each patient:

- The condition upon arrival at the hospital (age, weight, blood pressure).
- What tests were taken (blood, genetic mutations, MRI/CT scans).
- How they were treated (which chemotherapy, what dose, type of surgery).

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- **Most importantly:** Whether the disease recurred after treatment or not (if it did, after how many months/years).

AI analyzes this data and memorizes the specific common similarities among patients whose disease recurred.

2. Digitizing and integrating patient data Now imagine a new patient visits a doctor. The doctor inputs all the patient's data into the AI system. The AI categorizes this data and creates a "digital portrait":

- **Clinical signs:** For example, the tumor size is 4 cm, the patient's age is 45, and lymph nodes are affected.
- **Laboratory and genetic tests:** The level of tumor markers in the blood (e.g., CA-125 or CEA), presence or absence of a mutation in the p53 gene, Ki-67 (proliferation) index in the tissue.
- **Response to treatment:** After receiving neoadjuvant (pre-operative) chemotherapy, the tumor shrank by 30% (or conversely, did not respond).

3. Pattern Recognition The human brain can analyze 5-6 variables simultaneously. AI compares thousands of factors in a second.

- **Doctor:** *"The tumor has been completely removed, the lymph nodes are clear, so the risk of recurrence is low."*
- **AI analysis:** The AI system looks at its historical database and finds this pattern: *"Yes, the tumor was removed and the lymph nodes are clear. But this patient has mutation X and a specific architecture of blood vessels (angiogenesis) around the tumor. In my memory, out of 100 patients with the exact same combination, 82 had a recurrence after 3 years."*

AI looks not at a single isolated sign, but at a complex combination of signs.

4. Mathematical modeling and Risk Scoring After comparing all the data, AI launches specific survival probability algorithms (e.g., *Random Survival Forests* or *DeepSurv* neural networks). As a result, exact numbers and graphs appear on the doctor's monitor:

- **1-year recurrence risk:** 12%
- **5-year recurrence risk:** 68%
- **Recommendation:** *"Observation alone is not enough. Statistically, if this patient is additionally given the targeted drug 'N', the 5-year recurrence risk will decrease from 68% to 25%."*

Why is this so important? In traditional medicine, treatment protocols are standardized. All cancer patients at the same stage might be prescribed the same chemotherapy. AI offers the following possibilities:

1. **Avoiding overtreatment:** If the AI evaluates the risk of disease recurrence as very low, the patient can be spared from harsh and toxic chemotherapy.
2. **Rescuing high-risk groups (Undertreatment):** If the AI determines that the disease is aggressively hiding at the genetic level (high risk) despite appearing safe externally, the doctor can immediately begin the strongest therapy.

In conclusion, AI acts as an "intelligent consultant" by combining the collective experience of millions of past doctors and patients into one place, predicting the future of the current patient with mathematical precision.

EXISTING PROBLEMS AND PROSPECTS

Despite the achievements of AI technologies, several barriers exist in practice:

1. **The "Black Box" problem:** Neural networks cannot explain to the doctor the logic behind their decision-making. In medicine, transparency of decisions is crucial.

2. **Data security:** Artificial intelligence requires the personal medical data of millions of patients to function. Ensuring their confidentiality is a pressing issue in bioethics.

3. **Lack of standardization:** The quality of data obtained from different equipment and laboratories varies, which can negatively impact the overall accuracy of the AI model.

Deep Dive: The Issue of Lack of Standardization

You have highlighted a very pertinent and important issue. One of the biggest and most invisible barriers to the development of Artificial Intelligence (AI) in medicine is precisely the "lack of standardization."

AI algorithms do not think logically like humans; they only find patterns based on the data inputted into them. If the inputted data is of varying quality, formats, and appearances, the AI gets confused. In medicine, this problem clearly manifests itself in various areas.

Let's analyze this comprehensively through concrete examples:

1. Example in Radiology and Tomography (Differences in equipment) Imagine AI was trained to detect lung cancer based on tens of thousands of high-resolution images obtained from a "Siemens" computed tomography (CT) scanner at the most modern hospital in the capital. The AI showed 98% accuracy in this hospital. However, the exact same AI program is installed in a remote regional hospital. They use a "GE" (General Electric) or an older model of equipment there.

- **Problem:** Different machines scatter X-rays differently, slice thickness varies (e.g., one cuts at 1 mm, another at 3 mm), and image contrast (light/shadow level) differs.
- **AI Error:** The AI gets confused by seeing the "noise" (pixel difference) of the new machine instead of the cancer nodule in the lung tissue. As a result, its accuracy might drop from 98% down to 60%. In science, this is called **"Domain shift."**

2. Example in Histology and Digital Pathology (Differences in staining) In oncology, tissues are stained with special dyes (hematoxylin and eosin - H&E) for microscopic examination.

- **Problem:** The manufacturer of the reagents used in every laboratory is different. Furthermore, the chemical composition of the water (hardness or softness), room temperature, and the technician's staining time vary.
- **Example:** In laboratory "A", tissues appear dark purple, while in laboratory "B", they appear light pink.
- **AI Error:** If the AI was trained only on data from laboratory "A", it might falsely conclude that "cancer cells are dark purple." When it sees the pink images from laboratory "B", it will fail to find the tumor even if it is clearly visible.

3. Example in Clinical tests and Laboratories (Units of measurement) There is also no standard in analyzing data from a patient's electronic health record (EHR).

- **Problem:** One laboratory measures blood sugar levels in **mg/dl** (e.g., 100), while another uses **mmol/l** (e.g., 5.5). Or one doctor writes "Myocardial infarction" in the medical history, while another writes "Heart attack" or a specific ICD-10 code.
- **AI Error:** For AI, there is a massive difference between the numbers 100 and 5.5. If the system is not standardized, the AI might misinterpret (even comically) a patient with a blood sugar level of 5.5 as having "dangerously low blood levels."

What are the negative consequences of this problem?

1. **Spurious correlation:** AI memorizes the "signature" of the hospital rather than the disease symptoms. For example, in one study, AI was supposed to detect pneumonia, but it was found to base its answers solely on the text "Portable X-ray machine" in the corner of the X-ray image (since severely ill patients were imaged in their wards using these).

2. **Overfitting:** The model works perfectly for one clinic, but becomes completely useless if moved to another city or country.

3. **Socio-medical inequity:** If AI is trained exclusively on data from highly-equipped private clinics, it will not be able to correctly diagnose patients in rural polyclinics with average medical equipment.

What is being done to solve this? Modern science is taking the following measures to resolve this issue:

- **Data Harmonization:** Before inputting into the AI, intermediate algorithms are being developed to artificially bring all images to the same color and contrast (*Color normalization*).
- **Federated Learning:** Instead of gathering data in one place, the AI "travels" to servers in different hospitals to learn. This way, it encounters various machines and approaches, increasing its experience and adapting to diversity.
- **Strict protocols (DICOM, HL7):** International standards are being implemented that compel all hospitals to store medical data in the same digital format.

CONCLUSION

Artificial intelligence in oncology is not merely a technological novelty, but a strategic necessity for improving the quality of medical services. AI makes it possible to detect disease in its earliest stages, integrate pathomorphological and genetic data, and select the optimal therapy for each patient.

In the future, the synergy (collaborative activity) of AI and human (physician) intelligence will serve as the primary driver in transitioning oncological diseases from the category of fatal pathologies to manageable and chronic diseases.

REFERENCES

1. Topol, E. J. (2019). High-performance medicine: the convergence of human and artificial intelligence. *Nature Medicine*, 25(1), 44-56.
2. McKinney, S. M., et al. (2020). International evaluation of an AI system for breast cancer screening. *Nature*, 577(7788), 89-94.
3. Bera, K., Schalper, K. A., Rimm, D. L., Velcheti, V., & Madabhushi, A. (2019). Artificial intelligence in digital pathology—new tools for diagnosis and precision oncology. *Nature Reviews Clinical Oncology*, 16(11), 703-715.
4. Kather, J. N., et al. (2019). Deep learning can predict microsatellite instability directly from histology in gastrointestinal cancer. *Nature Medicine*, 25(7), 1054-1056.
5. Decree of the President of the Republic of Uzbekistan "On measures to create conditions for the accelerated introduction of artificial intelligence technologies" (2021).
6. **Kurbonovich T. B. et al.** (2026). *PROBLEMS IN MODERN CULTURE: SOCIO-SPIRITUAL ANALYSIS IN THE CONTEXT OF GLOBALIZATION AND DIGITAL TRANSFORMATION*. Global Science Review.
7. Kurbonovich T. B. et al. DIGITAL TECHNOLOGIES IN MEDICINE. TELEMEDICINE //IMRAS. – 2025. – T. 8. – №. 12. – C. 39-41.
8. Kurbonovich T. B. et al. ZAMONAVIY MADANIYATDAGI MUAMMOLAR: GLOBALIZATSIYA VA RAQAMLI TRANSFORMATSIYA SHAROITIDA IJTIMOIY-MA’NAVIY TAHLIL //Global Science Review. – 2026. – T. 18. – №. 1. – C. 183-188.
9. Panji o‘g‘li C. O. et al. REGENERATIVE PROPERTIES AND MODERN HISTOLOGICAL ANALYSIS OF CONNECTIVE TISSUE IN THE MORPHOFUNCTIONAL SYSTEM OF THE ORGANISM //AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE. – 2026. – T. 4. – №. 2. – C. 230-235.

ISSN NUMBER: 2692 - 5206 Volume 6. No 04. Aprel ,2026

10. Turdimuratov B.K. (2022). *Teaching Medical Sciences Using Innovative Methods and ICT*. Tashkent: Uzbekistan Medical Publishing House.
11. Kurbonovich T.B., & Bahodirovich, B.B. (2026). Step-by-step acquisition of practical skills in studying information technologies in medicine. *Global Science Review*, 17(1), 203–209.
12. Kurbonovich T.B., & Nurhayat, M. (2026). Compilation and steps of the medical situational issues algorithm. *American Journal of Applied Medical Science*, 4(2), 59–63.
13. Turdimurodov B.K., et al. The essence of electronic textbooks in medical education. *European Journal of Humanities and Educational Advancements*, 3(4), 48–50.
14. Shoxrullo S., Mirzohid B. MODERN CARDIAC SURGERY: EVOLUTIONARY MILESTONES AND CLINICAL RELEVANCE //AMERICAN JOURNAL OF APPLIED MEDICAL SCIENCE. – 2026. – T. 4. – №. 3. – C. 56-58.