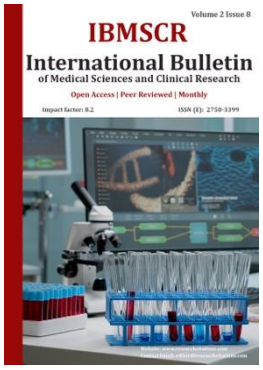

THE ROLE OF ARTIFICIAL INTELLIGENCE IN TUMOR DIAGNOSIS

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Abstract. Artificial intelligence is becoming an important tool in tumor diagnostics, increasing the accuracy and speed of early-stage pathology detection. Machine learning algorithms can analyze medical images and large clinical data sets, reducing the likelihood of diagnostic errors and assisting physicians in decision-making. The use of such technologies is particularly relevant given the rising incidence of cancer and the time constraints of specialists. This article examines the current capabilities of artificial intelligence in cancer diagnostics, its advantages and limitations, and the prospects for its implementation in clinical practice.

Keywords: Artificial intelligence, tumor diagnostics, oncology, machine learning, medical imaging.

Introduction. In recent years, there has been a steady increase in the incidence of cancer, making the issue of early diagnosis one of the key challenges facing modern medicine [3,4]. The effectiveness of treatment largely depends on the stage at which the tumor is detected; therefore, timely and accurate diagnosis plays a decisive role in reducing mortality and improving patients' quality of life [5]. However, traditional diagnostic methods rely heavily on the physician's experience and expertise, which can lead to variability in results and the risk of diagnostic errors [3]. Against the backdrop of rapid advances in digital technologies, the use of artificial intelligence in medical practice has become particularly significant [1,2]. Machine learning and deep learning algorithms are capable of analyzing large sets of medical data, including imaging results, laboratory values, and clinical information [1,5]. This makes it possible to detect pathological changes at an early stage, improve diagnostic accuracy, and reduce the workload on specialists. The implementation of artificial intelligence opens up new possibilities for cancer diagnosis, including the automation of image analysis processes, the standardization of data interpretation, and support for clinical decision-making. At the same time, questions remain regarding the quality of source data, the need for clinical validation of algorithms, and their integration into the existing healthcare system. Consideration of these aspects underscores the relevance of this topic and the need for further study of the potential of artificial intelligence in tumor diagnosis [2,4].

Methods. This study employs a comprehensive approach to analyzing the role of artificial intelligence in tumor diagnosis. A review was conducted of recent scientific publications and clinical studies focusing on the application of machine learning and deep learning algorithms in oncology [1,5]. Particular attention is paid to the analysis of medical image processing methods, including computed tomography, magnetic resonance imaging, and digital mammography [1,5]. Approaches to training algorithms on labeled and unlabeled data, as well as methods for classification, segmentation, and detection of pathological changes, are examined [2,4]. Methods for evaluating model performance, such as sensitivity, specificity, and diagnostic

accuracy, are also analyzed [1,2]. Additionally, issues related to the integration of artificial intelligence into clinical practice are examined, including the use of clinical decision support systems and the assessment of their impact on diagnostic quality [3,4].

Results and Discussion. The results of the analysis show that the integration of artificial intelligence into tumor diagnosis significantly improves the accuracy, sensitivity, and speed of detecting neoplasms [1,5]. Machine learning and deep learning algorithms demonstrate particularly high effectiveness in the analysis of medical images, including computed tomography, magnetic resonance imaging, and mammography, allowing even minimal pathological changes to be detected in the early stages of the disease [5]. In some cases, the accuracy of such systems is comparable to that of experienced specialists, and when used in combination with clinical assessment, a significant improvement in diagnostic outcomes is observed [2,4]. Additionally, it has been established that the use of artificial intelligence contributes to the standardization of the diagnostic process and reduces variability in the interpretation of results among different specialists [1]. This is particularly important given the heavy workload on the healthcare system and the limited time available to analyze each clinical case [2]. The use of automated systems also allows for faster processing of large volumes of data and increases access to high-quality diagnostics [3,4]. The discussion revealed that the effectiveness of algorithms depends directly on the quality and size of the training datasets, as well as on the accuracy of data annotation [1,2]. Insufficient representativeness or errors in the source data can lead to reduced accuracy and limit the applicability of models in real-world clinical practice. Furthermore, the issue of interpretability of decisions made by algorithms remains a significant concern, necessitating the development of more transparent and explainable models [2,5].

Conclusion. Thus, artificial intelligence represents a promising field in tumor diagnosis, capable of significantly improving the accuracy, speed, and efficiency of cancer detection [1,5]. The use of modern algorithms makes it possible to improve early diagnosis, reduce the likelihood of errors, and optimize the clinical decision-making process. Despite significant advantages, the implementation of artificial intelligence requires addressing a number of challenges related to data quality, clinical validation of models, their interpretability, and integration into the healthcare system [2,4]. An important prerequisite for successful application is the combination of artificial intelligence technologies with the physician's professional expertise. In the long term, the further development and refinement of these technologies will contribute to improving the quality of medical care and the prognosis for patients with cancer [5].

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