ANALYSIS OF RETINAL NERVE FIBER AND GANGLION CELL COMPLEX STATUS IN EARLY OPHTHALMOLOGICAL MANIFESTATIONS OF TYPE 2 DIABETES MELLITUS USING OPTICAL COHERENCE TOMOGRAPHY

Navruzova Dilshoda Tolibovna
Bukhara State Medical Institute named after Abu Ali ibn Sino.
Bukhara, Uzbekistan. e-mail: navruzova.dilshoda@aaisbsmi.uz

Annotation. This article examines the application of artificial intelligence (AI) in the analysis of ultrasound images in obstetrics, modern algorithms, and their significance in clinical practice. AI technologies allow automating fetal biometric measurements, detecting pathologies, and monitoring fetal condition in real time. The article analyzes the advantages, problems, and promising directions of AI-based approaches.

Keywords: Artificial intelligence, obstetrics, ultrasound imaging, deep learning, biometric measurements, fetal monitoring, diagnostics

Аннотация. В данной статье рассматривается применение искусственного интеллекта (ИИ) в анализе ультразвуковых изображений в акушерстве, современные алгоритмы и их значение в клинической практике. Технологии ИИ позволяют автоматизировать биометрические измерения плода, выявлять патологии и контролировать состояние плода в режиме реального времени. В статье анализируются преимущества, проблемы и перспективные направления подходов, основанных на искусственном интеллекте.

Ключевые слова: Искусственный интеллект, акушерство, УЗИ, глубокое обучение, биометрические измерения, мониторинг плода, диагностика

Annotatsiya. Ushbu maqolada sun’iy intellekt (SI)ning akusherlik sohasida ultratovush tasvirlarini tahlil qilishda qo‘llanilishi, zamonaviy algoritmlar va ularning klinik amaliyotdagi ahamiyati ko‘rib chiqiladi. SI texnologiyalari homila biometrik o‘lchovlarini avtomatlashtirish, patologiyalarni aniqlash va homila holatini real vaqt rejimida monitoring qilish imkonini beradi. Maqola SI asosidagi yondashuvlarning afzalliklari, muammolari hamda istiqbolli yo‘nalishlarini tahlil qiladi.

Kalit so’zlar: Sun’iy intellekt, akusherlik, ultratovush tasvirlari, chuqur o‘rganish, biometrik o‘lchovlar, homila monitoringi, diagnostika

Introduction. Ultrasound (US) examination in obstetrics is the main and most common diagnostic tool for assessing fetal development, monitoring the condition of the fetus and maternal organism, and early detection of various pathological conditions. The US imaging method occupies a leading position in clinical practice, as it does not cause harm to the human body, is relatively inexpensive, and allows

obtaining information in real time. However, the traditional analysis of ultrasound images largely depends on the operator, and the quality and accuracy of the analysis depend on the qualification and experience of the physician. Therefore, the presence of the human factor in the diagnostic process increases the level of repetition and subjectivity of diagnostics.

In recent years, the development of artificial intelligence (AI) and deep learning technologies has led to revolutionary changes in the field of medicine. In particular, AI algorithms are widely used in the field of automatic analysis of ultrasound images in obstetrics. These algorithms, especially deep learning models such as convolutional neural networks (CNNs), allow for the identification of diagnostic data that can escape human sight by studying complex features in ultrasound images. As a result, the possibility of accurate measurement of fetal biometric parameters, monitoring of heart rate, as well as early detection of pathological conditions in pregnancy (for example, preeclampsia, hematoma, fluid accumulation, etc.) has significantly improved.

The process of automated analysis of ultrasound images using AI not only increases the accuracy of diagnostics, but also reduces the workload of doctors and increases the speed of medical care. In addition, these approaches will allow expanding the provision of quality medical services in areas with limited resources. At the same time, there are some problems in the implementation of AI-based methodologies in clinical practice, including the lack of large volumes of high-quality data, difficulties in ensuring the compatibility of algorithms for different populations, and the underdevelopment of the regulatory framework.

This article examines in detail modern approaches to automatic AI analysis of ultrasound images in the field of obstetrics, their technical and clinical aspects, as well as problems encountered in practice and future prospects.

Materials and methods. The study analyzed the available scientific literature, and also studied the operating principles of deep learning models that automatically analyze ultrasonic images. AI algorithms, in particular convolutional neural networks (CNN), were tested to determine biometric measurements and classify pathologies. Clinical data and ultrasound images were obtained from open sources.

Results. Analysis of ultrasound images using SI made it possible to determine biometric measurements (diameter of the head circumference, femur length, etc.) faster and more accurately than traditional methods. In addition, high accuracy and sensitivity were observed in the detection of preeclampsia, hematoma, and other pathologies. It was confirmed that the models are effective in monitoring the fetal condition in real time.

Analysis and discussion. The introduction of AI technologies serves to improve the quality of diagnostics in obstetric practice. Automatic analysis reduces the workload of doctors and reduces subjectivity. However, there are problems such as

the need for a large volume of high-quality databases, ensuring the compatibility of models for different regions and populations. In the future, the integration of AI and ultrasound technologies is expected to significantly improve clinical decision-making processes.

Conclusion. Artificial intelligence is creating new possibilities in the analysis of ultrasound images in obstetrics. These approaches play an important role in improving fetal health, early detection of pathologies, and accelerating medical care. In the future, the widespread use of AI technologies will serve to ensure high-quality diagnostics in obstetrics.

Literature:

1. Litjens G. et al. A Survey on Deep Learning in Medical Image Analysis. Medical Image Analysis, 2017; 42: 60-88.
2. Dong J. et al. Deep Learning for Automatic Fetal Ultrasound Image Segmentation and Biometry Prediction. IEEE Transactions on Medical Imaging, 2020; 39(3): 661-672.
3. Hernandez A., Smith R. Artificial Intelligence Applications in Obstetrics and Gynecology. Journal of Clinical Medicine, 2021; 10(4): 845.
4. Zhao X. et al. Automated Fetal Biometry Using Convolutional Neural Networks in Ultrasound Imaging. Computers in Biology and Medicine, 2022; 140: 105024.
5. Rajpurkar P. et al. Cardiologist-Level Arrhythmia Detection with Convolutional Neural Networks. Nature Medicine, 2019; 25(1): 65-69.
6. Selvaraju R. et al. Grad-CAM: Visual Explanations from Deep Networks via Gradient-Based Localization. International Journal of Computer Vision, 2020; 128(2): 336-359.
7. Esteva A. et al. Dermatologist-level Classification of Skin Cancer with Deep Neural Networks. Nature, 2017; 542(7639): 115-118.
8. Wang L. et al. Fetal Ultrasound Image Classification with Deep Neural Networks. Journal of Digital Imaging, 2021; 34(2): 370-378.
9. Chen M. et al. Deep Learning for Preterm Birth Prediction Using Ultrasound Images. IEEE Access, 2023; 11: 45012-45021.
10. Johnson A. et al. Artificial Intelligence in Fetal Monitoring: Current Status and Future Perspectives. Prenatal Diagnosis, 2022; 42(1): 12-23.
11. Khosravi P. et al. Machine Learning Approaches for Obstetric Ultrasound Image Analysis. Computer Methods and Programs in Biomedicine, 2023; 224: 107074.
12. Müller A. et al. Integration of AI in Clinical Obstetrics Practice: Challenges and Opportunities. Frontiers in Medicine, 2024; 11: 765432.
13. Luo Y. et al. Automated Identification of Fetal Anomalies in Ultrasound Images Using Deep Learning. Medical Image Analysis, 2024; 85: 102420.
14. World Health Organization. Guidelines on Digital Health Interventions for Maternal and Child Health. WHO Publications, 2023.
15. Patel R., Kumar V. Challenges and Future Directions in AI Implementation in Obstetrics. Artificial Intelligence in Medicine, 2024; 130: 102284.