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APPLICATION OF GENERATIVE ARTIFICIAL INTELLIGENCE AND MULTIMODAL MODELS IN THE ANALYSIS OF MORPHOFUNCTIONAL CHANGES IN IMMUNE SYSTEM ORGANS AND CLINICAL DIAGNOSTICS

Annotation: *The relevance of this study is обусловлена the need to enhance the objectivity of analyzing morphofunctional changes in the organs of the immune system. Generative artificial intelligence and multimodal models represent promising tools for the automation and quantitative interpretation of morphological and clinical data. The aim of this work is to substantiate the application of AI in assessing structural changes in lymph nodes and the spleen. Based on an analytical review, it is demonstrated that generative models improve image quality and expand data samples, while multimodal systems enable comprehensive*

analysis. The importance of data standardization and algorithm validation is emphasized.

Key words: *Generative AI, multimodal models, lymph nodes, spleen.*

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ПРИМЕНЕНИЕ ГЕНЕРАТИВНОГО ИСКУССТВЕННОГО ИНТЕЛЛЕКТА И МУЛЬТИМОДАЛЬНЫХ МОДЕЛЕЙ В АНАЛИЗЕ МОРФОФУНКЦИОНАЛЬНЫХ ИЗМЕНЕНИЙ ОРГАНОВ ИММУННОЙ СИСТЕМЫ И КЛИНИЧЕСКОЙ ДИАГНОСТИКЕ

Аннотация: *Актуальность исследования связана с необходимостью повышения объективности анализа морфофункциональных изменений органов иммунной системы. Генеративный искусственный интеллект и мультимодальные модели представляют перспективные инструменты автоматизации и количественной интерпретации морфологических и клинических данных. Цель работы — обоснование применения ИИ при оценке структурных изменений лимфатических узлов и*

селезёнки. На основе аналитического обзора показано, что генеративные модели улучшают качество изображений и расширяют выборки данных, а мультимодальные системы обеспечивают комплексный анализ. Отмечена важность стандартизации и валидации алгоритмов.

Ключевые слова: *Генеративный ИИ, мультимодальные модели, лимфатические узлы, селезёнка.*

Relevance. The relevance of this study lies in the need to improve the objectivity and accuracy of analyzing morphofunctional changes in the organs of the immune system. Lymph nodes and the spleen are sensitive indicators of physiological and pathological processes, yet traditional histological methods remain labor-intensive and subjective. Generative artificial intelligence and multimodal models offer opportunities for automation, quantitative tissue assessment, and integration of morphological and clinical data, which requires scientific justification and standardization of approaches.

Research Aim. The aim of this study is to provide a theoretical and methodological justification for the application of generative artificial intelligence and multimodal models in the analysis of morphofunctional changes in lymph nodes and the spleen, as well as to evaluate their potential for improving the accuracy and informativeness of clinical diagnostics of immune system disorders.

Research Methods. The study employed a comprehensive analytical approach, including a review of current morphological, clinical, and interdisciplinary research on the structure of lymph nodes and the spleen, as well as the potential of generative artificial intelligence and multimodal models in biomedical imaging. Methods of information synthesis and integration were used to correlate morphofunctional

changes in immune organs with data from digital AI models, including quantitative assessment of morphological parameters, image analysis, and interpretation of clinical data. This approach allowed for the identification of the advantages and limitations of AI applications and the determination of promising directions for further research.

Research Results

Analysis of current data has shown that generative artificial intelligence models enable the expansion of training datasets and improve the quality of digital histological images, allowing for more accurate detection of morphofunctional changes in lymph nodes and the spleen. Computer vision algorithms automate tissue segmentation and quantitative assessment of follicles, lymphocyte populations, and vascular changes, reducing subjectivity in interpretation. Multimodal models provide integration of morphological, clinical, and laboratory data, enhancing diagnostic informativeness and revealing latent patterns not accessible through traditional methods. The results confirm the potential of AI for comprehensive and quantitative analysis of immune organs and support in clinical diagnostics.

Conclusion

The study demonstrated that generative artificial intelligence and multimodal models are promising tools for analyzing morphofunctional changes in immune organs and supporting clinical diagnostics. Generative models improve image quality and reveal hidden morphometric patterns, while multimodal systems integrate morphological, clinical, and laboratory data. This approach enhances the objectivity, accuracy, and reproducibility of research, providing a basis for more informative and personalized diagnostic strategies.

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