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IMPROVING THE EFFICIENCY OF NUMERICAL PROCESSING ALGORITHMS FOR BIOMEDICAL SIGNALS IN ARTIFICIAL INTELLIGENCE

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Abstract: Artificial intelligence technologies make it possible to radically increase the effectiveness of digital processing of biomedical signals in the field of modern medicine. Biomedicine signals are complex and variable data that reflect the various physiological processes of the human body, and their precision analysis is important in further improving diagnostic, monitoring and treatment processes in medicine. Traditional digital signal processing methods often face limitations in the complete and efficient processing of these complex signals. Therefore, advanced artificial intelligence algorithms open up new opportunities in this area, which serves to increase the efficiency of algorithms for digital processing of biomedical signals.

Key words: artificial intelligence, medicine, digital technology, algorithms, biomedicine, models, capabilities, transformation.

Biomedicine signaling is characterized by its complexity and variability. Signals such as heart rate, brain waves, electrical muscle activity change dynamically over time and are often contaminated with noise, artifacts, and other impurities. In this complexity and noisy environment, traditional digital signal processing methods such

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as filters, wave packets, and Fourier transforms are used in signal purification and basic feature separation. However, these techniques often have limitations in detecting all fine patterns in the signal, failing to provide full efficiency in analyzing complex and inaccurate signals. Artificial intelligence algorithms, specifically machine learning and deep learning technologies, provide new approaches to digital processing of biomedical signals. Machine learning algorithms allow automation of feature extraction from a signal and optimization of classification processes. These algorithms learn from large amounts of data and respond with high accuracy to new data. For example, machine learning methods are effectively used to identify different heart rhythm conditions or to monitor pathological changes in brain waves.[1]

In-depth learning models, on the other hand, have great potential in direct analysis of Biomedicine signals, automatic feature separation, and time-dependent pattern recognition. Architectures such as convolutional neural networks and recurrent neural networks allow for a high degree of precision analysis by studying complex structures of signals. These techniques are successfully used in the analysis of cardiac electrocardiograms, brain electroencephalograms and many other signals. Another important aspect of digital processing of biomedical signals using artificial intelligence is the possibility of real-time operation. In a clinical setting, it is important to obtain a quick and accurate result, and artificial intelligence algorithms are an effective tool in meeting this requirement. Real-time detection of heart rhythm disturbances or monitoring changes in brain activity is of great importance in providing emergency medical care. Also, with the help of artificial intelligence algorithms, the possibility of personalized medical services is expanding, taking into account the physiological characteristics of individual patients.[2]

Several key factors are important to improve the effectiveness of artificial intelligence in digital performance of biomedical signals. The availability of a quality and diverse database is required first of all. Artificial intelligence algorithms learn from a large number of data and contain different states, giving more reliable results. Also,

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the fact that the model is understandable and consistent facilitates its acceptance in a clinical setting. It is important for medical professionals to be clear how the model is making decisions and what it is based on. In addition, ensuring the confidentiality and security of information is of great importance in the medical field, and special attention should be paid to this aspect in artificial intelligence systems. There are also some problems with the applications of artificial intelligence in digital performance of biomedical signals. The lack of quality information, the high need for information, as well as the limited ability of the model to generalize, are cited as major problems. In the clinical setting, extensive testing and certification are required to ensure the reliability and safety of artificial intelligence systems. At the same time, it is important to work in cooperation with human specialists and take into account their experience, since artificial intelligence systems are not able to fully establish human decisions, but support it.[3]

In the future, the role of artificial intelligence in digital processing of biomedical signals is expected to increase further. With the help of new algorithms, improved neural networks and integrated systems, artificial intelligence makes revolutionary changes in the field of Biomedicine. With these technologies, the possibility of constant monitoring of the health of patients, early detection of diseases and the development of personalized treatment plans will expand. At the same time, the impact of artificial intelligence systems on human life and their ethical aspects should also not be overlooked. The role of artificial intelligence technologies in improving the efficiency of algorithms for digital processing of biomedical signals is important not only in technical achievements, but also in improving the quality and efficiency of the medical field. With these technologies, diagnostic processes in medicine accelerate, the possibilities of early detection and monitoring of diseases expand, which serves to improve the quality of life of patients. At the same time, the cooperation of artificial intelligence with human specialists, the support of their knowledge and experience, ensures more effective results in the field of Medicine.[4]

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Conclusion:

In conclusion, artificial intelligence is an important tool in improving the efficiency of numerical processing algorithms for Biomedical signals. It provides new opportunities for in-depth analysis of complex and noisy signals, automation, real-time operation, and personalized medical services. At the same time, it is necessary to focus on such issues as quality data, model intelligibility and data security. The role of artificial intelligence in the digital operation of biomedical signals will further expand in the future and serve to bring about revolutionary changes in the medical field. This is important in improving human health and making medical care more efficient.

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