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RESEARCH ON THE INFLUENCE OF NEURAL NETWORK PARAMETERS ON THE SPEED AND QUALITY OF ITS TRAINING IN ROBOT CONTROL SYSTEMS AND UNMANNED VEHICLES

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In the modern world, neural networks have become an integral component of contemporary technologies. In particular, they are widely and successfully applied in robotics and autonomous control systems. Their role is especially noticeable in the oeration of unmanned aerial vehicles and ground mobile robotic platforms,

where the ability to adapt, make independent decisions, and perform highly accurate analysis of the surrounding environment is critical.

Special attention should be paid to the application of neural networks in the military domain, particularly in military unmanned aerial vehicles. Modern reconnaissance and strike drones equipped with high-precision sensor systems, such as optical and infrared cameras, thermal imagers, radars, and laser rangefinders, widely employ deep neural networks for automated processing of visual information.

The parameters set before training and system operation can significantly influence the final result. Among these parameters, in addition to bias neurons, the most commonly used include neural network architectures and structures, activation functions, learning rates, and momentum coefficients. Each of these parameters plays an important role in the training process, since different hyperparameter settings can lead to dramatically different model performance [1]. The architecture and structure determine the number of layers and the interconnections between neurons, which directly affect the network's ability to model complex relationships in data. Activation functions determine how a neuron transforms the received information and whether the network can properly learn nonlinear relationships. The learning rate determines the speed at which weights are adjusted during training. At the same time, the momentum coefficient helps prevent the optimization process from getting stuck in local minima and stabilizes the learning process.

Therefore, studying the influence of these parameters on neural network training is an extremely important task in modern science. During training, parameters determine how weight updates occur, how quickly the system adapts to new data, and how effectively it identifies patterns in complex datasets. If these parameters are chosen poorly, the network may either learn too slowly or, conversely, quickly lose stability and fail to reach an optimal result.

In addition, incorrect parameter settings may lead to overfitting or underfitting of the model. In the case of overfitting, a neural network adapts too closely to the training data, losing its ability to generalize and perform correctly on new, previously unseen data. Underfitting, in turn, occurs when the model is too simple to represent the underlying structure in the data [2, pp. 4-9] and therefore cannot achieve the required level of accuracy. Both cases significantly reduce the effectiveness of artificial intelligence systems and require additional computational resources for parameter tuning and repeated model training.

In systems used in military applications, particularly in unmanned aerial vehicles, such errors can significantly reduce the efficiency of recognition systems or lead to incorrect object identification. This is especially critical during reconnaissance or combat missions, where the accuracy of information analysis and the speed of decision-making are crucial. Errors in target recognition, object

classification, or location determination may negatively affect mission outcomes and reduce the overall effectiveness of unmanned systems. Even small errors in prediction can accumulate and significantly affect the overall system performance [3, pp. 373–394].

Scientific research aimed at studying the influence of neural network parameters on the quality of their training and operation enables the determination of optimal configurations for solving specific tasks. In the course of such research, the impact of individual parameter changes on training speed, prediction accuracy, and model stability is analyzed. This enables the formulation of recommendations for selecting the most effective neural network architectures and configurations for different task types.

The obtained results can be used to improve the accuracy of computer vision systems, reduce model training time, and increase the reliability of intelligent systems operating under complex conditions. Furthermore, parameter optimization reduces computational costs, an important factor for systems operating in real time or under limited hardware resources. This is particularly relevant for unmanned aerial vehicles, where computational power and energy resources are often limited.

Thus, such research has not only theoretical but also significant practical value, as it contributes to the development of efficient data processing algorithms and the implementation of more reliable artificial intelligence systems in critically important application domains. The results of such studies may serve as a foundation for developing new neural network optimization methods, improving machine learning algorithms, and enhancing the efficiency of modern intelligent systems across various fields of science, engineering, and the defense industry.

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