ALGORITHMS FOR MONITORING THE STATE OF DYNAMIC OBJECTS AND MAKING DECISIONS BASED ON NEURAL NETWORKS.

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Abstract: *This article examines algorithms based on neural networks for monitoring the state of dynamic objects and decision-making. The study focuses on optimizing real-time monitoring processes and improving accuracy. The flexibility and efficiency of neural networks, particularly in data processing and analysis, are detailed. Additionally, the performance of the model has been tested in various scenarios, and the results have been analyzed. These algorithms are shown to be effectively applicable in automated control systems, industrial technologies, and security systems.*

Keywords: *dynamic object monitoring, decision-making, neural networks, real-time data analysis, algorithms, automated systems.*

INTRODUCTION

Problem statement. In today's world, modern information technologies are widely used. The main task of creating such systems is to improve the quality of services. Therefore, work is urgently needed to find new solutions for creating such systems. Despite all the advantages of neural networks, there are many difficulties in their application. This is because the neural network does not provide any documentary evidence as to why it considered this particular decision to be correct. Experts, however, do not advocate the possibility of literally "trusting the machine" and on this basis they do not fully support it.

The invariant methods of neural networks can be explained by the fact that

they have been very successfully used in various fields - where it is necessary to solve problems of prediction, classification and control. Neural networks have the ability to perform nonlinear modeling combined with a relatively simple implementation, which makes them an indispensable part of solving complex multidimensional problems, including those arising from monitoring the state of dynamic objects [1].

With the advent of the first computers, humanity sought to take on itself the solution of many tasks. One of the most difficult and important problems is the problem of making the right decision based on the analysis of many parameters of nonlinear dynamic objects. And, naturally, the possibility of automating this process, as a result (real diagnosis) does not affect the so-called "human factor", since its influence can be not only positive, but also negative. This has a positive effect on the experience accumulated over many years of practice and a negative effect on the poor health of the specialist.

Methods. Currently, many decision-making systems are known, but serious methodological difficulties stand in the way of developing such systems. Indeed, if different specialists understand the same problem in different ways, then the problem of how to systematize this knowledge arises? How to accurately describe a rather complex situation using logical rules? And finally, this is the main and most important difficulty, when the

necessary knowledge may not be available at the time of developing the system. For example, in modern industries there are no effective methods for predicting problems that arise, and the reason is insufficient knowledge of this area. And this list can be continued for a very long time. Therefore, attempts are being made to create a system that knows more than its creators [3].

Ideally, the monitoring method should have one hundred percent sensitivity (not missing real problem situations) and at the same time one hundred percent specificity (not classifying a problem-free task as problematic).

Usually, high sensitivity leads to low specificity. This is explained by the fact that for all dynamic objects, the fact that a certain parameter exceeds the established norm does not mean that there is a problem. This is where the individual characteristics of the organism of dynamic objects come into play. Ideally, boundaries should be drawn.

A "problem/solution" is formulated for each dynamic object. Neural networks, which are nonlinear systems that are much better at classifying data than common linear methods, can increase the sensitivity of the method without reducing its specificity.

Neural networks have been shown to make decisions based on hidden patterns in the data they detect. They are not programmed - they do not use any inference rules to make a diagnosis, but learn from examples. This is the main difference between neural networks and expert systems. Another advantage of neural network technologies is that they have the ability to perform classification by generalizing previous experience and applying it to new situations [3].

Initially, it was assumed that a neural network should work like the human brain. A large number of neurons and their connections are responsible for maintaining the unique abilities of the human body. The brain itself, consisting of slow-acting cells, is capable of processing a huge amount of information flows almost instantly.

But even the very first networks were not very similar to this, and their capabilities were very limited. With the further development of neural network technologies, developers are forced to create artificial networks with properties that are impossible in living nature [4].

Results. Neural network methods can be used independently or serve as an excellent addition to traditional statistical analysis methods, which can be considered in the next part of the article [6].

In the modern world, specialists can use the capabilities of neural networks to make correct diagnoses, clean biological signals from noise and select useful information from various available information according to certain criteria [2]. And these are far from all the possibilities that can be realized with the help of a neural network.

An example of a large system is a centralized system in which the number of classified problems exceeds ten, and the number of symptoms is several hundred. Such systems consist of several levels, and in each of them, as a result of the work of local recognition systems, cases are determined that are used to identify more complex situations at the next levels of the system [5].

Decision-making system using a neural network. From all of the above, we can conclude that although neural networks are ultimately introduced into the system with the aim of

completely replacing the specialist at the diagnostic stage, this process cannot be carried out without experts.

The most interesting option for using neural networks in dynamic objects may be the ability to create a pattern, as shown in the figure below. Experts receive information about the system directly during the examination. An artificial neural network (ANN) gives a result - a diagnosis, but the final right to make a decision remains with the expert.

The information retrieval system (IRS) in this scheme is designed to compensate for the possible lack of knowledge of the expert in complex and rare cases and acts as an advisor.

The blocks of logic filters of converters 1,2 (LFC1, LFC2) serve to provide the input results for the ANN and IRS in the form necessary for their operation.

A very important block in such a scheme is the block of logic filters of converter 3 (LFC3). The purpose of this block is to present the work of ANN and IRS in a form that is as easy as possible for an expert to understand.

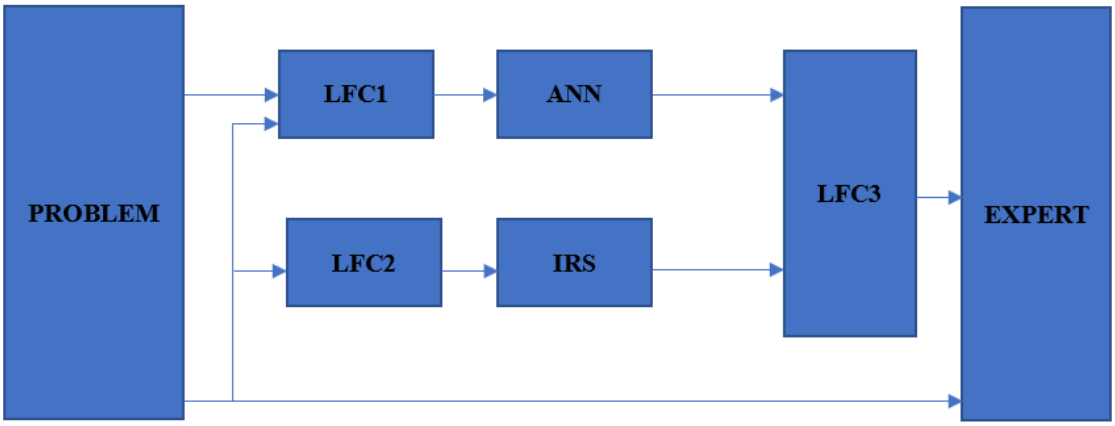

Figura 1. Experts information system artificial neural network.

Conclusion. It is when such a scheme is used that maximum efficiency in diagnosis is achieved. The results of ANN and IRS are truly helpful and stimulating thinking.

A helpful and stimulating effect on the clinical thinking of an expert can also have many other pieces of information, which are often analyzed by experts before making a final decision: a description of previously encountered similar cases of the problem, a description of the problems associated with the assumed problem and its visual representation in dynamics, etc.

It is planned to implement the program and test the proposed structure.

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