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PREDICTION OF STUDENT LEARNING OUTCOMES IN THE COURSE "PROGRAMMING" BASED ON NEURAL NETWORKS

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Annotation
The article describes a hybrid approach in the education process. This approach is based on the introduction of artificial intelligence into the learning process. The results of practical experiments in training such a hybrid network are presented.

Keywords: neural networks, hybrid neural networks, hybrid training system, optimization.

INTRODUCTION

One of the directions of development of information technologies are systems built on the basis of the theory of artificial intelligence, the algorithms of which are far from the level of human thinking, but already surpass in their indicators classical solutions that do not contain elements of artificial intelligence. Data mining (IAD) or data mining is the process of identifying meaningful correlations, patterns, and trends in large volumes of poorly formalized data. Considering the high growth rates of the information accumulated in modern data storages, the role of the IAD can hardly be overestimated. One of the areas where the use of neural network technologies provides ample opportunities is the formalization of knowledge. [5] Neural network (NN) methods can be used in any situation where you need to find the values of unknown variables or characteristics from known observation or measurement data. NS are used under the following conditions: If a problem can be solved by a person; If, when solving a problem, it is possible to single out a lot of input factors (signals, signs, data, etc.) and a lot of output factors; If a change in the input factors leads to a change in the output [4].

MATERIAL AND METHODS

Currently, various training systems based on the use of information and communication technologies have become widespread. They differ in many parameters: in the degree of distribution of the control function between the user and the system (in some, the user can independently choose the trajectory of his progress within the system, while in others this function is partially or completely assigned to the computer); by the degree of combination of theoretical and practical components; the presence or absence of a controlling function. The creators of the various systems chose a combination of

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parameters appropriate for the purpose of the system. However, all information technology training systems in the process of use have the potential to accumulate statistical information about the trajectory of students in the complex, about the mistakes they made in the process of work, about the success of passing control tasks, etc., which can be used to optimize the functioning of the complex.

Fig 1. Model of the hybrid training system

Neural network technologies were used to classify students. Classification is understood as the division of objects into several sets, the number of which may not be known in advance. To solve this problem, the Kohonen network was used. This network consists of one layer of neurons and is trained without a teacher, based on self-organization. To increase the effectiveness of goal-setting, diagnostics and correction, methods of fuzzy logic were used in order to determine the sections of the course that present the greatest difficulty for students. An artificial immune system is used to optimize the micro-target system (target component). The artificial immune system belongs to genetic algorithms, which makes it suitable for the optimization of multi-criteria function [3]. Artificial immune system model.

DISCUSSION

According to the principles of interaction between teaching tools and the student, software tools can be divided into learning environments and learning programs. The learning environment assumes that the teacher sets his own learning goals and achieves them with the help of the program. Such systems are characterized by a lack of control, since the program does not know the student's goals. For training programs, on the contrary, determinism in setting goals and the presence of control over their achievement is characteristic.

A.O. Krivosheev [3] offers the following classification of training programs:

• computer (electronic) textbooks provide an opportunity to independently study the educational content;

• subject-oriented environments [9, 6,7] represent software packages operating with objects of a certain class;

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• laboratory workshops provide an opportunity to perform laboratory work in various disciplines;
• simulators serve to practice practical skills;
• control programs are designed to assess the knowledge of students;
• instrumental systems [1, 2, 6, 7,] are designed to create training programs;
• reference books, databases provide the student with various information of a reference nature.
The disadvantage of this classification is that modern computer systems for teaching purposes contain features of several classes from those indicated.

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I. Savelyev [7] distinguishes automated training systems, which are defined as systems that allow the teacher to own courses in the system and program the algorithm for their study and individual software packages designed to automate labor-intensive processes, optimize, and study mathematical models.
A.V. Solovov [4] proposes to divide software products into two groups. The first is any software used in training. The second group includes instrumental systems designed for the development of training programs and the creation of training courses. However, modern systems have features of both the first and the second group.
In [5], the following optimization scheme is presented. The logical structure of the training content is presented as a sequence of content elements $A_1, A_2, \ldots A_m$. $A_1, A_{2,} \ldots, A_n$ between content elements exist within subject relationships, which are expressed in the fact that the A_i element is used in the study of the A_j,element, with a normal content structure $i < j$.The system of links between elements of content can be specified using a graph. To characterize the system of connections in [5], the following indicators are used.
The bond length A_i, A_j o is determined as follows:

$$P(A_i, A_j) = j - i \quad (1)$$

Coupling efficiency is the reciprocal of its length

$$E(A_i, A_j) = \frac{1}{P(A_i, A_j)} \quad (2)$$

Average bond length is determined

$$P_{cp} = \frac{\sum P(A_i, A_j)}{m} (3)$$

Where $\sum P(A_i, A_j)$ the sum of the lengths of all links, and m is the number of links. The efficiency of a logical structure is defined as the reciprocal of the average length and can be expressed as a percentage

$$E = \frac{100}{P_{cp}}\% (4)$$

Thus, the smaller the average length of links in the logical structure of training, the more efficient the training is. The hybrid learning system used the immune system to optimize the logical structure.
Results of work for the implementation of the hybrid system, the following user interface was developed.

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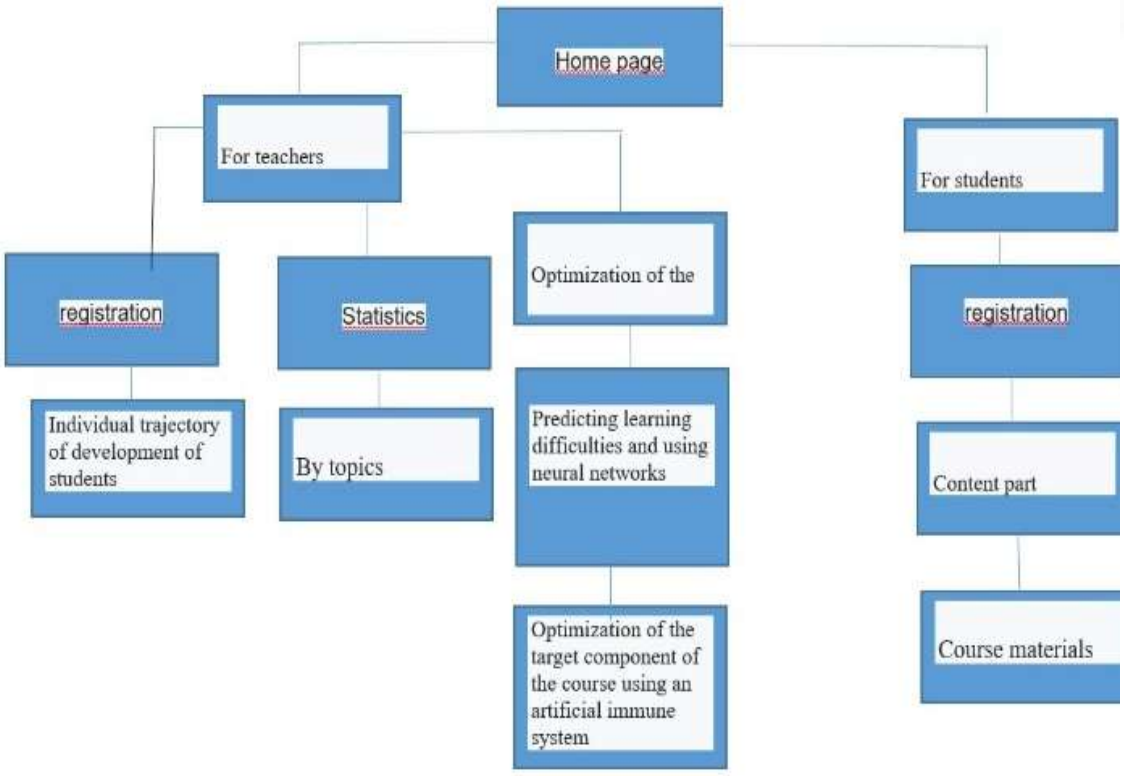

Fig 1. 1.Model of the hybrid training system with user interface

RESULTS

When solving the above problems, the following research methods were used:

• Substantiation and development of a mathematical model for assessing the complexity of educational texts, its verification and correction in relation to the peculiarities of the Russian language;

• Creation of an automated technology for analyzing the complexity of educational texts and assessing its productivity;

CONCLUSION

The subject of the research is to analyze the possibilities of automating the assessment of the complexity of educational texts based on statistical parameters using information technologies. The main hypothesis of the study is that information technology for assessing the complexity of educational texts will improve their objective characteristics that affect the effectiveness of assimilation if it is:

• built into mass technologies for working with text;

• equipped with a sound methodology for its use.

In conclusion, it should be said that student education, like many other industries, is growing steadily.

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