FEATURES AND CHARACTERISTICS OF ARTIFICIAL INTELLIGENCE SYSTEMS

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Artificial intelligence refers to the field of informatics, one of the tasks of which is to simulate human intelligence in an artificial way - with the help of a computer.

Artificial intelligence is a very promising field of research, the development of which is determined by achievements in the computer field. It can be assumed that the spread of computers and cybernetic devices, their use for human needs will determine the standard of living in the next century. The high productivity of new technologies largely depends on the use of artificial intelligence in them.

The most important practical result is the creation of expert systems – programs that simulate the work of a human expert in a certain subject area.

Under the control of the expert system, the computer, using information about the subject field, makes logical conclusions and composes answers to questions as a person – an expert in his field – would do.

Any expert system consists of three main parts – a database, a knowledge base, and logical inference programs. The database contains information about concepts and objects of the subject field. Knowledge base – information about their behavior and methods of interaction. Analysis of a specific situation, logical conclusions, and compilation of answers to questions are performed by logical deduction programs. The work of these programs is based on the principles of human intelligence.

An expert system is a computer system that embodies the experience of an expert based on his knowledge in a certain field. Based on the processing of this knowledge, the expert system (ES) can give intelligent advice, make decisions at the level of a professional expert, and also, at the user's request, explain the solution process in case of finding a particular solution [2]. The main differences between data processing systems and expert systems based on knowledge processing are as follows:

1. At the output of the expert system, the user receives not a machine or a videogram, which is presented in tabular form, but an intellectual advice in the form of text.
2. ES is based on the technology of symbolic information processing, which is mostly presented in the form of rules.
3. The expert system has an architecture that also differs from the architecture of traditional data processing systems. The differences consist in the presence in the expert system of such blocks in: knowledge base; explanations; accumulation of knowledge [3].

The knowledge base is a collection of information about the subject area for which an expert system is being developed [4].

For the system to function, the knowledge base must be filled with knowledge. For this, highly qualified specialists in the field for which the system is being developed are invited, they play the role of experts whose task is to describe all known knowledge for the functioning of the ES. Knowledge of the first and second types must be available in the knowledge base. Knowledge of the first kind is generally known facts, phenomena, regularities, which are recognized in this subject area and published. Knowledge of the second kind is a set of empirical rules and intuitive conclusions that specialists use when making decisions under conditions of uncertainty in the presence of incomplete and contradictory information. Information about this knowledge, as a rule, is not published [1].

The ES knowledge base mainly contains knowledge of the first kind, but there should also be knowledge of the second kind. If this knowledge is missing, it means a bad choice of experts (they do not know how to formulate their knowledge or vice versa: they do not want to do it in order to preserve the status of unique specialists).

All knowledge presented in the knowledge base is divided into intentional and extensional. Intentional, or abstract, knowledge is notional (conceptual) knowledge about the objects of the subject area and the connections between them.

Extensional (specific) knowledge is the quantitative characteristics of the intentional part of knowledge, that is, the ES database [3].

A block of decisions, necessary for searching and constructing logical solutions, which are issued to the user by ES. The actions of this block are similar to the reasoning of a human expert who evaluates a problem and offers its hypothetical solution. This block performs the functions of managing the process of finding solutions, that is, it determines the way and sequence of using various rules and procedures. Each ES should contain a certain number of such rules and procedures. The number of rules contained in an average ES exceeds 500, and for a large ES it can exceed 1000 [3].

Mostly the junction block in consists of two parts: a logical output block and a control block. The block of logical inference performs actions similar to the intellectual activity of a specialist when he makes a decision. The functions of this block are the construction of a logical conclusion based on the existing knowledge stored in the knowledge base.

The control unit manages the process of finding a solution, that is, it determines the sequence of using various rules and procedures for manipulating knowledge.

The block of explanations serves to issue, at the user's request, a sequence of logical conclusions and considerations, which were used by the system in the process of finding a solution. The presence of such a block in the ES makes it possible to use it not only for making decisions, but also for the learning process as an educational system.

The problem of explanations and substantiation of the correctness of reasoning is an important and difficult task. After all, despite the fact that the system contains the knowledge of experts and provides advice, the user is personally responsible for the decision made. There are still no legal acts that would determine the responsibility of experts for the knowledge provided to the system, as well as for decisions made as a result of consulting users with the ES, which contains the knowledge of a given expert or group of experts.

In order for ES to be able to quickly and qualitatively explain the correctness of his answers, as well as the adequacy of the questions asked, he records the course of his reasoning and their sequence in his working memory.

The fact of being able to get an explanation gives the user the illusion that the system is checking the compliance of the rules recorded in the knowledge base. Meanwhile, the EU explains its actions only by issuing information about the progress of the reasoning process.

Justification is the text that the user will get after using this rule, intending to get an explanation.

The issue of automated acquisition of knowledge by an expert system (updating, correcting and expanding ES knowledge through the ES learning process) is of increasing interest. The problem of learning can be reduced to the creation of new concepts and rules on the basis of existing ones, as well as connecting them to the knowledge base in such a way that there is no contradiction of knowledge.

Creating new knowledge in a fully automated way is a very problematic approach proposed by overenthusiastic artificial intelligence advocates. Any knowledge (especially new) requires a very thorough check, which can only be performed by experts.

However, expert systems currently have some limitations:

- They usually work only in narrowly defined problem domains, and their level of understanding of the environment in which they work is somewhat superficial.
- These and systems still do not have "common sense", as means they certainly cannot think about the problem in multiple ways or at multiple levels. They don't know when they don't know anything relevant to the problem; it's a means that they can try to solve problems even when their knowledge and way of thinking is clearly inappropriate, and they won't be able to communicate that fact to the human user.
- They cannot learn by themselves.
- There are performance issues with response times on many systems.
- Expert systems can be expensive and risky to develop. Even when specialized hardware and software are not required, distilling human experience, encoding it, and storing it in knowledge bases for use in expert systems can be time-consuming and labor-intensive. The skill required for this is not available in many cases.

Despite these limitations, many computer corporations have developed applications of expert systems, both experimental and operational, that are deployed in use today. They concluded that these systems represent strategic competitive technology [1].

Research directions of artificial intelligence systems:

- development of theoretical foundations for the creation and application of artificial intelligence systems for various purposes;
- theoretical foundations and applied problems of creating intellectualized robotic systems;
- modeling of human intellectual activity and its application in artificial intelligence systems;
- of means and systems of intellectualization of computer interfaces;
- development of intelligent control systems for autonomous robots and robotic complexes;
- creation and application of highly intelligent multimedia and hypermedia technologies and tools for artificial intelligence systems;
- creation of educational programs and virtual environments with elements of artificial intelligence;
- analysis, synthesis and modeling of neural networks, development of methods of their design, optimization and training;
- development of neurocomputer application technologies, applied systems based on neural networks [2].

An expert system is a system that contains information about concepts and objects of a certain subject area, information about their behavior and methods of interaction, as well as logical conclusion programs; it is intended to simulate the work of a

human expert in this field. The main characteristics of the expert system are as follows:

1. The expert system, as a rule, is limited to a certain subject area.
2. ES must be able to make decisions based on incomplete or inaccurate data.
3. ES should be able to explain their actions when solving the problem.

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