INNOVATIVE TECHNOLOGICA
METHODICAL RESEARCH JOURNAL
ISSN: 2776-0987 Volume 4, Issue 5 May 2023

CREATION OF AN INTELLIGENT SYSTEM TO SUPPORT MEDICAL DIAGNOSIS

Klicheva Firuza Gulmuratovna
Lecturer Karshi State University,
vip.qilicheva@mail.ru

Eshboev Erkin Abdurashidovich
Senior Lecturer Karshi State University,
eshboyeverkin666@gmail.com

Annotation
The article deals with the issue of creating an intelligent system that works on the basis of the method of generalized assessments and helps in making medical diagnoses, based on the technology of extracting knowledge from databases. The components of the created system are described. An example of the result obtained with the help of the developed system is given.

Key words and phrases: intelligent system, databases, hidden knowledge, generalized evaluation, sample file, object, object visualization, evaluation, data mining, data flow.

This article discusses the issue of creating an intelligent system that solves a number of issues in the field of medicine, working with a large amount of data, and its application in the field of medicine.
Many researchers and individual practitioners in a number of fields accumulate large amounts of data during their careers. But the only thing that people are interested in, and in most cases they want from experts, is to quickly get the data they need. In fact, databases act like a memory or a complex notebook; user access to the database allows you to get only a small part of the stored data in response to certain questions [1]. When we have a large stock of collected data, the main challenge is to optimize the management of relevant processes, to get the knowledge hidden in the data to improve the performance of the organization and to use this data in the most efficient way as much as possible. For example, in medical organizations for a more accurate study of the characteristics and laws of operation of very complex objects, such as biological systems or the human body.

ISSN: 2776-0987 Volume 4, Issue 5 May 2023

It was possible to act in the old, proven (traditional) way, that is, to collect a huge army of analysts and statisticians who operate on this data using traditional data analysis tools. However, it seems that at present this task cannot be solved only by human forces because of the magnitude of the tasks. We can say that the use of human intelligence does not solve this problem. Solving the problem requires a qualitatively different approach.

On the other hand, traditional solutions are simply expensive and not cost effective. In addition, the results obtained by analysts are not always objective, since usually people work with specific or implicit assumptions, some basic ideas about the subject being studied, which does not affect the objectivity of the results [2].

There is confusion in medical institutions about which type of treatment is preferable for patients, how to organize clinic resources most efficiently, or how to reduce the cost of treatment by outsourcing most of the analytical work to a machine [3]. The use of technologies that automatically extract new knowledge, such as models, relationships, patterns and guarantee their statistical significance, helps to automate the analysis process and make it more objective.

Extracting knowledge from databases (KDD - knowledge discovery in databases) is the analytical process of human exploration of a large amount of data using automated tools.

In the process of studying given data in order to identify hidden structures or connections from given data, the full or partial existence of basic ideas about the nature of hidden structures and connections is assumed. In this regard, KDD includes a preliminary understanding and incomplete statement of the problem (in terms of target variables), automated data analysis and their transformation into a format available for primary processing, automatic knowledge analysis, hidden structures using approbation or care for them. identifying dependencies. These patterns are patterns discovered using new approaches that have not been used for human interpretation of the discovered patterns [4].

Knowledge extraction is the exploration and discovery of hidden structures or relationships in raw data using "machines" (algorithms, artificial intelligence tools). They can be:

- previously unknown knowledge;
- the data is considered insignificant;
- Practically useful data.

KDD is a synthetic field that uses the latest advances in artificial intelligence, numerical mathematical methods, statistics and heuristic approaches and automates knowledge discovery based on database technology (KDD) aimed at solving the above problems. It can be seen that the purpose of the technology is to search for laws and relationships hidden in the database that cannot be detected by traditional methods. It should be noted that not only “routine” processes are assigned to the machine (for example, testing the statistical significance of a hypothesis), but also processes that were not previously called routine in any way (development of a new hypothesis). CDD not only allows you to see the relationship between data that the researcher had not even guessed before, but also serves to increase the effectiveness of individual treatment of the patient and the effectiveness of the medical institution as a whole. Also, building a model using QDD allows you to establish a quantitative relationship between the characteristics of the phenomenon under study [5].

Using these and similar new technologies, it is possible to create intelligent systems (IT). One of such IT is IT, based on methods for calculating generalized estimates. This method calculates the generalized cost of objects in the sample files generated from the results of the experiment. As a result, it is possible to calculate a generalized estimate of an object that is not found in the sample, but whose features correspond to the features of the objects in the sample file. The IT that performs this task consists of the following parts [6]:

• Control unit (creation of a digital model);
• assessment of the object under study based on the model;
• Visualization of the studied object;

Important file of choice for IT. This file contains training data for the computer. This file produces a module file that is used to diagnose a specific disease.

The selection file must contain entries (by line), object number values, and symbols (by column). The file is in *. csv and can be opened in an Excel spreadsheet or any text editor.

Control block (creation of a numerical model). This part reads data from the required selection file. It calculates the weights using formula (1) for each symptom column in the read data [7].

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$$\left(\frac{\sum_{i=1}^{2} u_i^1\left(u_i^1-1\right)+u_i^2\left(u_i^2-1\right)}{\sum_{i=1}^{2}|K_i|\left(|K_i|-1\right)}\right)\left(\frac{\sum_{d=1}^{2}\sum_{i=1}^{2} u_i^d\left(|K_{3-i}|-u_{3-i}^d\right)}{2|K_1||K_2|}\right)\rightarrow \max \qquad (1)$$

In addition, generalized estimates are calculated using formula 2 [8].

$$R(S)=\sum_{i=1}^{n} w_i t_i\left(x_i-c_2^i\right)/\left(c_3^i-c_1^i\right)(2)$$

The system generates a module file based on the results calculated by formulas (1) and (2). Table 1 shows an example of a module file generated by the system:

№	Alomat nomi	c0	c1	c2	w	Ti
1	alive-at-1	1	1	3	0,2901	-1
2	age-at-heart-attack	35	64	86	0,32	1
3	pericardial-effusion	1	1	2	0,2405	-1
4	fractional-shortening	0,01	0,18	0,61	0,2969	-1
5	epss	0	14,3	40	0,3314	-1
6	lvdd	2,32	5,15	6,74	0,3041	1
7	wall-motion-score	5,5	16,5	39	0,3151	1
8	wall-motion-index	1	1,375	3	0,3242	1
9	mult	0,28	0,812	1,003	0,2526	-1
10	survival	0,25	7,5	57	0,6923	-1
fayl nomi:	b_Exokardio,csv	Minimum bahosi	-0,376852	Maksimum	1,101773	

Table 1. Sample module file

The part of IT that uses formula (2) to calculate the cost of an object takes data from Table 1.

Evaluation of the object under study based on the model. After training a computer based on models created for certain diseases, it can diagnose other objects for these diseases. The diagnostic process begins with the introduction of symptoms related to the object. Symptom input values are compared with the diagnostic parts of various diseases and processed into the part associated with the corresponding model.

Visualization of the studied object. It is important to visualize the processed information about the object so that it is understandable.

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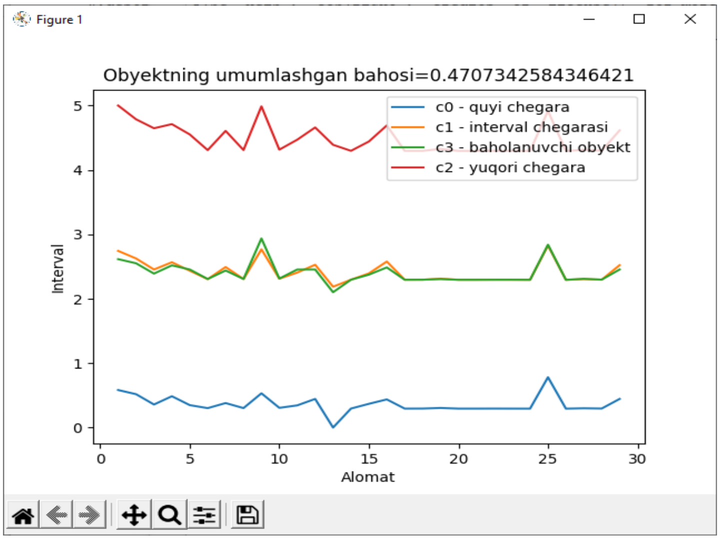

Figure 1. Sample output from IT

On fig. 1 shows a generalized assessment of the included hypertension object and a graph of its location at the intervals determined by the symptom columns. As can be seen from the graph, the patient being examined for hypertension is near the border of the interval. This situation reflects the suspicious appearance of the examined object in relation to the disease. The resulting conclusion is accepted by a specialist.

The main task of the IT being developed is to help professionals working in the field of medicine make clear and reliable decisions to address a number of issues that arise in this area. It also allows to resolve the issue of a differentiated approach to diseases.

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