COGNITIVE TECHNOLOGY. SYNTHESIS AND OPERATION OF APPLICATIONS

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ABSTRACT

In this paper, the toolkit for the automation of system-cognitive analysis is considered, which is the universal cognitive analytical system "Eidos". This system is one of the options for software implementation of the proposed mathematical model and the numerical method of system-cognitive analysis.

Key words: *automated system-cognitive analysis, cognitive analytical system, information model, model adaptation.*

КОГНИТИВНАЯ ТЕХНОЛОГИЯ. СИНТЕЗ И ЭКСПЛУАТАЦИЯ ПРИЛОЖЕНИЙ

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АННОТАЦИЯ

В данной работе рассматривается инструментарий автоматизации системно-когнитивного анализа в качестве которого выступает универсальная когнитивная аналитическая система "Эйдос". Данная система является одним из вариантов программной реализации предложенной математической модели и численного метода системно-когнитивного анализа.

Ключевые слова*: автоматизированный системно-когнитивный анализ, когнитивная аналитическая система, информационная модель, адаптация модели.*

INTRODUCTION

The presence of this toolkit that automates system-cognitive analysis allows us to introduce into a new term: automated system-cognitive analysis (ASK-analysis), which is understood as a system-cognitive analysis equipped with a mathematical method, a method of numerical calculations and software tools that implement them.

The Eidos universal cognitive analytical system is a domestic licensed software product created using officially purchased licensed software. There are more than 100 publications on the "Eidos" system and various aspects of its practical application, including 5 monographs and one textbook. The "Eidos" system is a software tool that implements a mathematical model and a methodology for numerical calculations of system-cognitive analysis. It provides the following functions:

1. Synthesis and adaptation of the semantic information model of the subject area, including the active control object and the environment.

2. Identification and prediction of the state of the active control object, as well as the development of control actions for its transfer to the specified target states.

3. In-depth analysis of the semantic information model of the subject area.

The Eidos system is a special software tool that implements the proposed mathematical model and numerical method (data structures and algorithms) and solves the problem of this work.

DISCUSSION AND RESULTS

The synthesis of the model in the system-cognitive analysis is carried out using the subsystems: "Dictionaries", "Training", "Optimization", "Recognition" and "Analysis". It includes the following steps:

1) formalization (cognitive structuring of the subject area);

2) the formation of the studied sample and its management;

3) synthesis or adaptation of the model;

4) model optimization;

5) measuring the adequacy of the model (internal and external, integral and differential validity), its rate of convergence and semantic stability.

This type of work is carried out using the "Recognition" and "Analysis" subsystems. These subsystems provide: input of the recognized sample; batch recognition; output of recognition results and their assessment, incl. using data on the differential validity of the model.

This analysis is performed in the "Typology" subsystem, which includes:

1. Informational and semantic analysis of classes and features.

2. Cluster-constructive analysis of recognition classes and features, including visualization of the analysis results in the original graphical form of cognitive graphics (semantic networks of classes and features).

3. Cognitive analysis of classes and characteristics (cognitive diagrams and Wolf-Merlin diagrams).

The "Eidos" system includes 7 subsystems: "Dictionaries", "Training", "Optimization", "Recognition", "Typology", "Analysis", "Service".

The structure and interaction of these subsystems make it possible to fully implement all aspects of systems-cognitive analysis in a user-friendly form. Both the control structure and the system dialogue tree correspond to the generalized structure. The subsystems, modes, functions and operations implemented by the "Eidos" system are described in more detail in the works.

In the titles of the sections with descriptions of the subsystems and modes of the "Eidos" system, the codes of the basic cognitive operations of system analysis implemented by them are indicated in accordance with the generalized scheme of system-cognitive analysis.

Subsystem "Dictionaries" provides formalization of the subject area. It implements the following modes: classification scales and gradations; descriptive scales and gradations; descriptive scale gradations; hierarchical levels of systems organization; automatic input of primary characteristics from text files; postal service for normative and reference information; printing a questionnaire.

Classification scales and gradations are intended for entering a directory of future states of the active control object - classes. Mode: "Classification scales and gradations" provides a database of classification scales and gradations of classes: input; adjustment; deletion; printout (to a text file); sorting; database search.

Descriptive scales and gradations are intended for entering directories of factors influencing the behavior of the active control object - signs. This mode provides input, deletion, correction, copying of the names of descriptive scales and associated gradations. A characteristic feature of the "Eidos" system is the possibility of using non-alternative gradations, of which there can be a different number on different scales (within wide limits). The reference book allows you to work directly with gradations (taking into account connections with scales), see their total number, as well as view and print the percentage distribution of respondents' answers.

The levels of organization of systems (levels of Wolf Merlin) are an independent way of classifying classes and factors, which makes it easy to create and analyze their various subsets both by themselves and in comparison with each other. V.S. Merlin

proposed an integral concept of individuality, in which he considered the interaction and interdependence of various levels of personality traits:from genetically predetermined, to socially determined and reflecting the momentary state. The "Eidos" system provides for an apparatus that allows one to classify factors in such a way that it becomes possible to study various levels of their organization and interdependence. The levels of organization of classes are intended to classify the future states of the active control object as target and undesirable from the point of view of the control object itself and the control system, as well as various combinations of these options. Other types of classification are also possible.

The "Eidos" system provides a solution to the problems of attribution of anonymous and pseudonymous texts (establishing probable authorship), dating texts, determining their belonging to certain traditions, schools or currents of thought. In this case, the various structures that make up the texts are considered as their attributes. A special mode is implemented in the "Eidos" system, which provides automatic detection and input of these text attributes directly from text files.

The technology of work in the "Eidos" system does not provide for the simultaneous work of many users with the same databases in the mode of correcting records. Therefore, it is possible to efficiently organize distributed work using multi-machine technology without using a LAN. To ensure the necessary identity of directories on different computers, the "Postal service for reference data" mode is used.

Classification scales and gradations in economic, socio-psychological and political science studies are often questionnaires (questionnaires). To print them to a file (to the "TXT" subdirectory), use the "Print questionnaire" mode. In the "Eidos" system, all text and graphic input and output forms are automatically saved in the form of files, convenient for use in various applications under Windows.

This subsystem provides input and adjustment of the training sample, its management, synthesis and adaptation of the model based on the data of the training sample, export and import of data from other computers.

To enter-correct the training sample, the corresponding mode is used, which has a two-window interface, which allows you to enter two-vector descriptions of objects into the training sample. The left window is used to enter the classification characteristics of the object. In this window, each objectmatches one scrolling line. In the right window, a descriptive characteristic of the object is entered in the language of signs. Each object has a corresponding scrollable window. The transition between windows is carried out by pressing the "TAB" key. The number of objects in the

training set is not limited. There is practical experience in performing calculations with training sample volumes up to 7000 objects, the total number of descriptive scale gradations up to 3900 and the number of classes up to 1500. The possibility of automatic formation of training sample objects by encoding text files is also implemented.

The system implements a number of software interfaces that provide automatic generation of classification and descriptive scales and gradations, as well as a training sample:

- import of data from files of the "DOS Text" standard;
- data import from DBF-files, prof. A.N. Lebedev;
- data import from transposed DBF-files, the standard of professor A.N. Lebedev;
- generation of a random model;
- generation of a training model for studying the properties of natural numbers.

The practical significance of the research is the development of the ASK-analysis toolkit - the Eidos Universal Cognitive Analytical System, technologies and methods of its use, which provide: creation of automated monitoring systems, identification (forecasting) of the states of active objects of the agro-industrial complex and their management; reliable operation of these systems in industrial mode during mass information processing; in-depth data mining in the agro-industrial complex.

CONCLUSION

Implementation of the results. The experience of using ASK analysis confirms the effectiveness of its application in the following subject areas: sociological and political science research, analysis of public opinion (Krasnodar sector of the Institute for Sociological Research of the USSR Academy of Sciences, Krasnodar Regional Agroindustrial Committee, Academy of Civil Service under the President of the Russian Federation, Krasnodar State Institute of Culture, Information and analytical center of the administration of the Krasnodar region, the Analytical center of the administration of the Yaroslavl region, etc.); design of adaptive ACS with complex technical objects (State Enterprise Special Design Bureau "Ikar", Kuban State Technological University); solving a number of problems of managing the quality of training of specialists (Krasnodar Law Institute of the Ministry of Internal Affairs of the Russian Federation); identification and analysis of the macroeconomic conditions of cities and districts of the Krasnodar Territory and the Territory as a whole based on the assessment of the significance of macroeconomic indicators and the use of

methods of statistical information theory and artificial intelligence (Department of Economics and Forecasting of the Krasnodar Territory Administration); forecasting the results of the application of agricultural technologies and management of the cultivation of agricultural crops (Kuban State Agrarian University); forecasting the success of future professional activities in extreme situations in conditions of high responsibility and lack of time (North Caucasus Regional Search and Rescue Service of the State Committee of the Russian Federation for Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters of the Ministry of Emergency Situations, Novoship JSC Novorossiysk Shipping Company), solving problems Center for Government Communications in the Krasnodar Territory.

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