

# MIVAR technologies of the development of intelligent systems and the creation of the active multi-subject online MIVAR encyclopedia

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## **Abstract:**

*The basic results of 25 years of development of the MIVAR technologies are described and compared with other methods of data storage and processing. A new project of creation of the active online MIVAR encyclopedia is proposed.*

**Keywords.** MIVAR, databases, artificial intelligence, intelligent systems, expert systems.

## **1. INTRODUCTION**

The problem of the intellectual activity modelling with the aim of an artificial intelligence (Ai) creation remains actual and important [1-3]. The MIVAR approach makes it possible to offer new models and methods of information processing and management. Here, we will understand artificial intelligence systems as active, self-training and logically arguing systems. In the last century, various technologies of the creation of expert systems in separate narrow-targeted domains have been developed. Such situation has been caused by complexities of the formalized description of demanded subject domains and also by the fact that systems of a logic conclusion couldn't process more than 20 objects/rules. At the same time, "intellectual packages of applied programs (IPAP)" had been developed, allowing solving problems in different areas where calculations and designing of algorithms of the decision of problems were required. IPAP technologies are being developed in MIVAR technologies and in the service-focused architecture. In the Internet, various forms of help and training systems are being developed as, for example, Wikipedia or the project "Tungsten". The Russian fundamental innovative technology "the MIVAR approach" [4, 9, and 13] allows using evolutionary databases and knowledge (rules.) in order to form the uniform educational and help space. The active MIVAR Internet encyclopedia will comprise not only the facts in different subject domains, but also active programs for the solution of various logic and computing problems (technology IPAP and services).

## **2. THE MIVAR APPROACH**

In the MIVAR approach, the concept of databases, computing problems and logic problems are unified in a single technology. The MIVAR approach has been developed since 1986 and includes 2 basic technologies [2-13]:

1) Evolutionary databases and rules (knowledge) with changeable structure on a basis of MIVAR information space of the unified representation of data and rules, based on the concept of "thing, property, the relation" - for the storage of any information with change of structure and without restriction on volume and representation forms;

2) The system of logic conclusion or "algorithms construction" on the basis of active trained MIVAR networks of rules with linear computing complexity - for information processing, including a logic conclusion, computing procedures and "services".

Unlike the traditional approaches dividing database storage, logic conclusion and computing processing [1, 14-21], the MIVAR approach allows to create the multidimensional and evolutionary systems that process the information in real time combining logic conclusions and computing processing. The MIVAR approach is based on the fact that real world exists in itself, an individual imaging the description of this world in the form of the initial three-dimensional space which axes are concepts: thing, property and relation. These three concepts are the abstractions convenient for the description of the real world. It is to notice that the MIVAR approach is a modern approach for working out of intellectual systems and, in the long term, for the creation of artificial intelligence systems [2-13].

## **3. LOGIC-COMPUTING PROCESSING, MIVAR AND DATABASES**

Solution of various problems requires accomplishing both logic and computing data processing. Historically, the areas of a logic conclusion and computing processing have been developing independently and have been successfully solving various classes of problems. Somewhat, there existed a contradiction between these approaches [1, 9, 14-21]. Besides, the problems of processing and storage of the various data were divided. Databases were used mainly for storage and search of the demanded data, and system of a logic conclusion and calculations were applied to the information processing, the search of solutions, etc. These areas turned to be poorly crossed, though the purposes of association of all functions on accumulation and information processing in one system [1-20] were regularly proclaimed.

The analysis of almost all models of data representation is carried out in the paper [8]; relational, network, hierarchical, semantic networks, ontology, and "essence-communication" and MIVAR information space (in the whole, more than 25 data models). M.P. Kogalovsky describes the evolution of database technologies and systematizes data on the major technologies in [14]. A.S. Markov and K.J. Lisovskij ([18]) have proved their choice of computational logic methods for the increase of level of intellectuality of relational databases. A.S. Markov introduces the concept of "logic programming of the relational databases" as one of the names of the direction of "deductive databases". A.R. Sajmon conducts the multidimensional analysis of key areas of modern mass technologies of databases and estimates the prospects of their development in [20]. D.A.

Pospelov describes in [19] the Russian approach to the productions and its processing. In [1], the structures of data and basic algorithms of modern methodology of program elaboration are examined in detail. In [16], some trails of one of the most popular semantic data models - an "Essence-Relation" model (ER-model) - are examined. In [9], formal representations of data structures of ER-model and MIVAR information space are shown.

Thus, there were theoretical workings on the unification of logic and computing processing. MIVAR information space (MIVAR model of the data) seems to be the most promising of all data models [9].

#### **4. PRODUCTIONS AND MIVAR CONSTRUCTION OF MIVAR COMPUTER LOGIC NETWORKS**

First of all, we will consider the problem of the construction of MIVAR computer logic networks over the databases. It is to underline that MIVAR information space allows to create evolutionary "multi-modelling" databases and rules without restrictions on volume of the stored data and with the possibility to change the structure of data storage. Unlike existing highly specialized expert system, the offered Active MIVAR Internet encyclopedia will represent a meta-expert system in which all saved knowledge of mankind will be collected, the possibility of its direct application always available. This essentially new possibility is presented by the MIVAR approach to realization of computer logic data processing on the basis of knowledge bases named *bases of rules* [9]. MIVAR networks implement continuation and development of productive the approach. The productions are known to be useful to describe every logic dependence or problem [19]. The MIVAR approach develops further this capacity and includes whatever computing procedures in the form of some "services" [21].

#### **5. UDAV, THE PROTOTYPE OF MIVAR ACTIVE ENCYCLOPEDIA**

Let's consider the program the UDAV as a prototype of MIVAR encyclopedia. The UDAV (the Universal maker of algorithms of Varlamov) is designed for the decision of difficult computer logic problems in real time by the "designing of algorithms" or the "search of the route of logic conclusion" with linear computing complexity. It is not the simple algorithm of information search or implementation of rigid algorithms, but namely an INTELLECTUAL solution of problems involving construction of algorithms, active inquiries of the missing information and search of solutions.

Three basic stages of MIVAR information processing are the following:

- 1) Formation of MIVAR matrix for the description of subject domain;
- 2) Work with the matrix and designing of algorithm of problem solution;
- 3) Execution of all calculations and answer finding based on the received algorithm.

The first stage - matrix formation - is the stage of the conceptual model of subject domain synthesis and its formalization in the form of productive rules with the transition to MIVAR rules:

"Entrance objects - rules/procedures - target objects".

At present, this stage is the most difficult and requires the participation of a person-expert in order to create the MIVAR subject domain model. From the point of view of training it is important that on the basis of the second stage the BOA carries out "explanations" for the trainee, shows and proves the way of solution. Classical productive approach is of too high computing complexity.

Advantages MIVAR the approach are:

- Linear computing complexity and real operating time;
- Solution of logic and computing (and others) problems;
- Management of a stream of the entrance data and operative diagnostics;
- Adaptive description and the continuous solution of problems;
- Active work with inquiries or specifications of the entrance data of the evolutionary network of rules and objects (self-training).

#### **6. MODELLING OF HUMAN THINKING AND MIVARS**

The hypothesis of human thinking modelling as of logically arguing self-training system consists in the following. It is possible to present the process of thinking in a formalism of the MIVAR approach - in the form of MIVAR logic network (information processing) operated with a stream of the entrance data from the sources. All data - objects-essences, their attributes-properties and relations-connections - are stored in the MIVAR information space [2-13]. On the basis of this space logic networks are being formed and numerous multidimensional dynamic logic operation cycles and information storages are being formed.

In the course of training, the person reveals a thing (essence, object) and correlates it to other objects through elementary relations. Simultaneously it is possible to reveal properties (attributes, "monadic relations") of a new thing. On the basis of definition of new essence, a new "concept" to which new relations with already known substances are attributed is being formed. Thus, a multidimensional space of data presentation and rules is being formed in the head of a person. On an input of logic system, new data signals are constantly arriving. In the system, the processing priorities can be changed; the new purposes can be formed, etc. The thinking model on the basis of the MIVAR approach should include a space of constantly changing rules, the input parameters of which are transferring into output. Actually, it is also a continuous movement in difficult logically arguing system.

#### **7. THE QUANTITATIVE ESTIMATION OF THE INFORMATION AND THE MIVAR APPROACH**

Let's consider MIVAR the approach in application to the quantitative estimation of the information from the point of view of logic processing and information modelling, instead of information transfer in bits. This estimation depends on completeness of information model of subject domain and on the conditions of logic processing (a logic conclusion). The estimation is calculated on the MIVAR networks of logic rules on the basis of definition of values of those objects (variables),

which are necessary for achieving the end of logic processing and acquisition of demanded results. Possibility of a quantitative estimation is caused by the features of the MIVAR networks of rules, allowing calculating of those variables which values are not sufficient for the end of logic processing.

Here follows the algorithm of the quantitative estimation of the information sense. It is given the MIVAR space of unified data and rules presentation filled in order to recover some concrete subject domain. The MIVAR logic system of conclusion is operated with a stream of entrance data and with the list of variables that are to be defined - "Required" objects [9]. In MIVAR space, several non-connected descriptions of objects and rules can be saved. Then, in the course of information processing, a certain description is being formed on the base of entrance and "required" data, which is called the "information model". Let the logic conclusion stop at some moment of the processing because of a lack (shortage) of the data. In this case, a procedure of definition of those objects - the variables which values are necessary to continue processing - begins. For the moment, all undefined objects have various quantitative estimations. For example, objects that are directly necessary to continue processing will have the highest quantitative estimation. Any "auxiliary" objects necessary for definition (calculation) of the specified above objects will have a little lower estimation. On the basis of calculated "quantitative estimations of the information" for each object at MIVAR information space the values of initially demanded objects are being calculated.

## **8. THE HYPOTHESIS OF THE FORMALIZED MODELLING OF THE "INSITE"**

It is possible to present human thinking as a logic arguing self-training system. In the formalism of the MIVAR approach, the thinking is represented in the form of MIVAR network of the logic processing operated with a stream of entrance data from the sources. Under the "insight" - the inspiration - it is accepted to understand "the sudden finding of the decision". We will show how this inspiration can be formalized and modelled on the basis of the MIVAR approach.

After the definition of initial and required objects, the system of logic processing begins to search for a relation - the route of a logic conclusion from initial to required objects. If the problem is simple enough such relation can be found very quickly and there is no place for "inspiration". But if the subject domain description is very difficult and the process of search of the route of a logic conclusion (from initial object to "required" object) is complicated, the output variants turn to be numerous, and the process of search itself to be delayed.

According to the hypothesis, all information models can be represented in the form of the MIVAR information space. In this space, a measure of distance between different points of the space [9] is defined. On the basis of this measure, it is possible to determine formally what "branch" of a logic conclusion leads to the results that is the closest to the demanded one. This knowledge may be not formalized, but the feeling of the "proximity of the solution of the problem" - familiar to all of us - is probably a display of the effect of approach to the demanded result in the MIVAR logic network.

## **9. THREE LEVELS OF THE RESEARCH IN THE FIELD OF ARTIFICIAL INTELLIGENCE**

On the basis of the system analysis, it is offered to allocate three basic levels of research in the creation of systems of artificial intelligence - AI.

1. Reflexive pre-intellectual level - "instincts, reflexes". Neural networks and similar methods are close to instinctive reactions, reflexes, etc. when it is necessary to execute instantly a certain action. It seems to be very important, but in the standard sense it is impossible to name this networks "the intellectual realized activity". Neural network is something "pre-intellectual", but very important for diagnostics, reactions. Genetic algorithms represent the case when it is necessary to offer any decisions for CHALLENGES that can't be solved with the aid of intelligence. We suggest classifying the neural networks and genetic algorithms it suggested as "pre-intellectual" level of AI. We can face such level at animals (dogs, dolphins, etc.)

2. Logic intellectual level. At this level we will understand the studying of a "black box" when we try to get inside and to simulate it, to open a secret of the black box, to clean out the black box. As it is known, the neural networks and genetic algorithms don't open black boxes, they work only with "inputs and outputs" of such box, as they are founded only on statistics.

3. Non-formalized OVER-INTELLECTUAL level. The attention to questions of consciousness, conscience, etc. intellectual systems is always paid by the scientists. These problems are obviously outside the limits of "the logic realized thinking", since not even a person realizes these processes and not always can formalize them. Here it is possible to classify various emotions, feelings, morals and similar questions. There is a position: "let's make at first at least "logic intelligence", and then we will prosecute subjects of its conscience and emotions". But, there are scientists to whom the problems which will arise right after AI are important and interesting.

Moreover, the MIVAR approach has already allowed creating working program complexes which automatically elaborate algorithms (the program "the BOA. Geometry"). We hope to realize able to independent logic processing, i.e. to creation of a prototype of artificial intelligence. In our opinion, AI creation should develop from the simple to the difficult: at first, it is necessary to model the activity of the elementary beings, then animals and so, gradually to rise to the human and its thinking.

## **10. CONCLUSIONS**

On the basis of the MIVAR approach it is possible to create universal active Internet encyclopedia which will contain both the facts, and services for the problem solution and an explanation of all logic and computing problems. It will play an important role for the strategy of realization of "life-long learning". The MIVAR encyclopedia will be the development of existing information systems, from Wikipedia to "Tungsten" and etc. Besides, all these systems can be used together and mutually supplement each other.

The hypothesis of modelling of thinking in a formalism of the MIVAR approach is offered: in the form of the MIVAR networks of logic processing when logic

operation cycles and information storages are formed.

It is suggested to allocate 3 levels of scientific researches: pre-intellectual (diagnostics, management - neural network etc.); Intellectual (logic reasoning, decision-making and information processing in the MIVAR information space - knowledge, etc.) and OVER intellectual (problems of consciousness, conscience, etc.).

The MIVAR approach to a quantitative estimation of sense of the information from the logic point of view is developed and can be realized in the MIVAR information space.

The hypotheses of the formalized description and modelling of the "insight" - inspirations of thinking on the basis of MIVAR network are offered.

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