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# **Increasing the Efficiency of the Decision Tree for Decision Making**

**RahimovNodirOdilovich**

Assistant Professor, Department of Basics of Computer Science, Tashkent University of Information Technologies  
Named After Muhammad Al-Khwarizmi, Tashkent, Uzbekistan

**ABSTRACT:** This article proposes an approach for increasing the efficiency of building a knowledge base in the formation of alternative to decision support solution in a service oriented information system to maintain a large amount of information resources with an aim of forming a decision tree. The generalized structure of effective formation of a knowledge base by elimination of errors at creation of decision tree is developed.

The improvement in quality of alternative solutions, the reduction in the expansion of the database in the formation of the knowledge base, as well as the saving of the resource of processes and memory in information system are justified.

**KEYWORDS:** Information Resource, Information System, Knowledge Base, Decision Tree, Rules Base, Production Model

## **I.INTRODUCTION**

Nowadays changing environmental requirements and current trends in the globalization of the development of society, management and monitoring issue have become more complex. Large amounts of data processing, analysis, forecasting and the difficulty of assessing the situations in question involve the use of modern information and communication technologies (ICT) and enterprise information systems (EIS) [1]. Such systems combine business strategies and information technologies of decision support systems, thereby ensuring the effectiveness of corporate information management. The main functional components of such EIS are electronic information resource (EIR), information-analytical system (IAS), decision-making system (DMS) [1]. The EIR stores processed structured and structured data from external and internal sources. However, formalized and stored non-formalized data reflecting the hidden relationship on data of the studied processes [1-3].

Currently, when building information systems, intended to manage large sets of EIR, one of the main problem is the formation of a package of alternatives, quality solutions that support decision making through the effective organization of the knowledge base. Since the increase of the size of the information, resource (the increase of data or knowledge) leads to difficulties in the formation of internal rules [1]. Traditionally in the formation of the knowledge base, when creating a decision tree, use methods such as direct and inverse insights, the full selection. The implementation of these methods leads to the formation of a large volume of calls and queries when expressing the path on decision tree is the cause of the complication of the calculation process, increasing time and resource costs.

When troubleshooting a combinatorial explosion in the organization of the process it is possible to achieve efficiency of calculation process by eliminating repeated queries in the decision tree. This requires high clarity of the generated rule base. This forms the basis of perfection of the mechanism of the conclusions, the organizer of the knowledge base and quality of alternatives generated by the decision.

Thus, the formation of a decision tree in AIR of large volume is not determined only by the results of the selected queries, or a properly organized search. For alternatives are important database, which is the core of management information resource and decision tree rules that are generated.

The enrichment elements of the information system focused on the formalization of expert opinions with the help of knowledge base creates a basis for communication “man machine” [2-4]. All systems of the intellectual analysis of the available data relies on a knowledge base formed on the basis of the elements of expert systems, intelligent agents [1]. Such systems contain modules, connection-oriented databases and knowledge bases (Fig1.).

Normalized volumes of search queries in information resources, the formation of the perfect decision tree is associated with the formation of it knowledge and logical deduction [7].

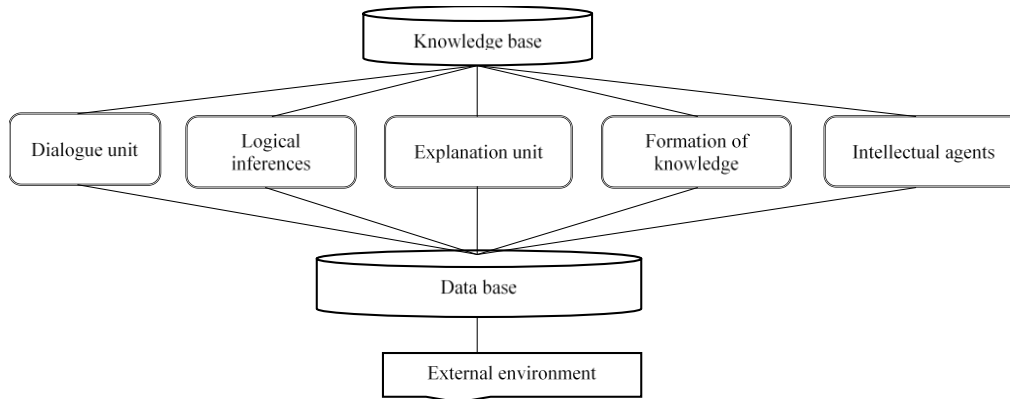


Fig1. Intelligent data analysis based on knowledge base

*Task setting.* Let the reason of some rule in the knowledge base is R the set of rules consisting as a part of other rule in which other essence, and also forming a circuit participates. Considering the drawn basis of arguments as the reverse inference in a decision tree, to define as follows its complexity: r - the average volume corrected, n - average value of conditions in a rule body, d - average spanning by rules. Then the search tree will consist from N peaks [4]:

$$N = r + \sum_{i=1}^d (rn)^i \tag{1}$$

But in this case the full comparison of arguments of realization on each peak at formation of a tree of search leads very big (aspiring to infinity) to iteration. Then in order to avoid some peaks process of search Q can be carried out in a following type

$$Q = \sum_{i=1}^{m-1} (rn)^i \tag{2}$$

The given approach can be ineffective at great volumes of an information resource. As for avoidance of collision with peaks, it is required, that the volume of processes has been connected to d-coverage, and also to remember search results  $N - (rn)^d$  in each iteration. It leads to magnification of volume of processes and need for temporal resources. For creation of a tree of effective decisions, it is required to create the knowledge base containing corresponding R rules.

## II. THE APPROACH OF INCREASE OF WORKING EFFICIENCY OF THE KNOWLEDGE BASE

As it is known, production model is close to logical models and allow forming effective mechanisms of the inferences. Absence in them of strict restrictions optimally for interpretation production elements.

The production model based on rules, expresses knowledge in a type “If (condition), Then (action)” [6, 8]. At such approach, the great value acquires definition of creation of a decision tree.

It is known that the peak of decisions allows constructing the linear dependence.

$$Y = f(x),$$

here  $x$  - set of characteristics of signs,  $Y$  - set of results. Therefore, the formed each rule expresses linearly, and productivity of the knowledge base produces the set consisting of set of segments. The condition on avoidance of contradictions here should be satisfied, and differently there is the infinite iterative process. For classification based on the signs characterizing object, there is a row of effective algorithms. As in the given operation classification is the main question expediently to pay attention to aspect of elimination of errors.

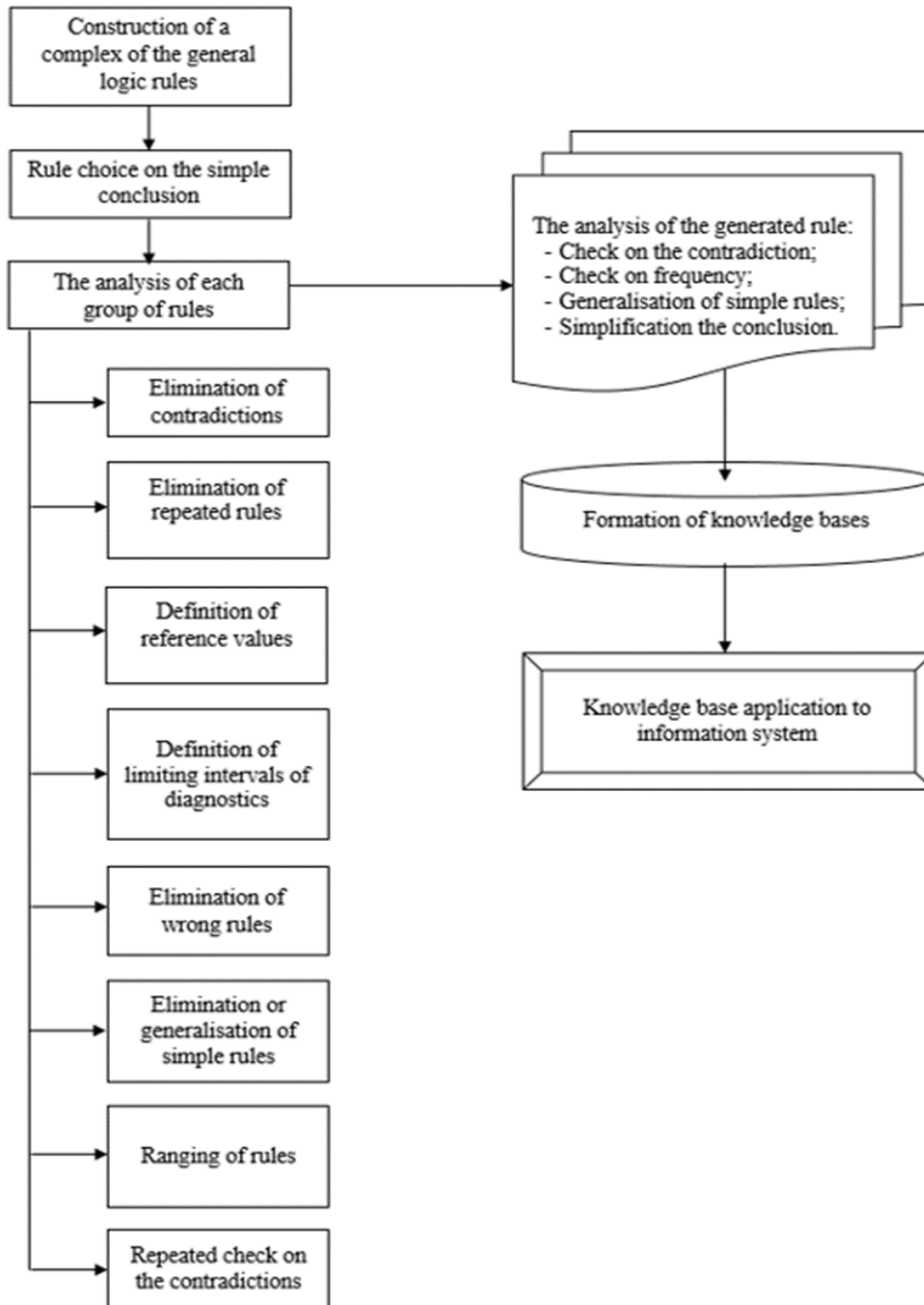


Fig2. The generalized structure of formation of knowledge bases

Occurrence of the latent rules of tops of a tree of decisions unpromisingly, in particular if it is generated from characteristics of the same object. The process directed on reduction of errors in a tree of decisions, is realized in following stages:

At the first stage it is calculated  $E_0(t)$ ,  $t$  - volume of errors in top.

$$E_0(t) = \sum_{l=1}^L \sum_{\omega=1}^K U_l^\omega, \tag{3}$$

here  $L$  - volume of the tops allocated  $t$  with tops,  $K$  - volume of classes of diagnostics,  $U_l^\omega$  – volume,  $\omega$ – objects in a class, corresponding  $l$  to top.

At the second stage,  $E_0(t)$  is an error. Then achievement  $G(t) = E_0(t) - E_l(t)$  (the top point, possessing in great volume) is defined. The top in which most of all achievements leaves and formed iterative process. The general view of the given process looks as follows (Fig2).

The given approach with definition  $A, B, C, D,$  and  $E$  can yield effective results at formation of the tree leading to the certain decision and expression of some set process. For example, the following tree (Fig3). Here repetitions with ring lines are resulted.

The intensification of process of search in a tree of decisions can be considered in the decision of the question connected with increase of efficiency of search it is resulted in Fig3.

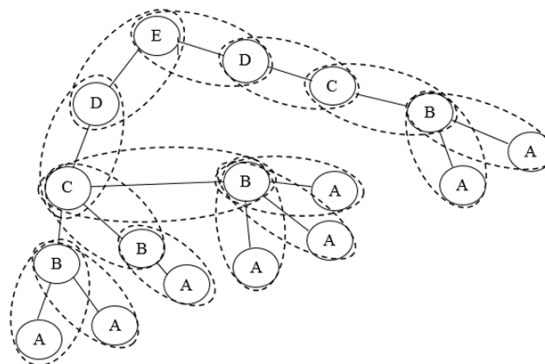


Fig3. A tree of decisions for decision-making

**III. INCREASE OF EFFICIENCY OF SEARCH IN THE KNOWLEDGE BASE OF INFORMATION SYSTEM**

At creation of a network of decisions in information systems, it is possible to observe a chain of repeating rules (production) [9-10]. It in turn leads to creation of an "erroneous" network in a tree, demands additional time and computing resources in process realization. As the decision of the given problem, it is possible to consider check of results of the previous search, also effectively consecutive calculation of crossed concepts.

Let in some  $t - t$  he  $e$  – event passing in an  $s$  – condition is given time. Occurring  $e$ -event is given we will consider as  $F$ -argument and as a result  $F = \{S, E\}$  we will receive a following rule:

$$R: (\{S_{t-1}\}, \{e_t\}) \rightarrow S_t$$

We need to define  $e_t$  – event rather a  $S_t$ – condition in time + process.

For this purpose, first of all we will calculate by testing a condition (argument), corresponding to the following:

$$t_1 = \frac{1}{2} \delta(|P| + m(F)) \quad (4)$$

here  $\delta$  - time of formation of one argument, P - set of arguments соответствующих to the following, m - average value of initial arguments. The given process is iterative, and in each iteration proceeds before full scanning of the data, the base of all corresponding arguments in a kind is formed

$$t_d = \delta|P| \quad (5)$$

with removal of initial arguments. Here the increase in quantity of arguments depending on volume of iterations can be observed.

For decrease in increase in arguments indexation and selection of arguments in the course of search have great value  $T_i$ . For this purpose it is necessary to carry out an intensification in a kind

$$T_x = \prod_{i=1}^d \delta F \quad (6)$$

Here we will result of production a rule in the following kind:

$$\text{If } (t_1 = \frac{1}{2} \delta(|P| + m(F)) \text{ and ... and } t_d = \delta|P|, \text{ then } T_x = \prod_{i=1}^d \delta F \quad (7)$$

Intensification and

$$\text{If } (t_1 \approx T_1) \text{ and ... and } (t_d \approx T_x), x = \overline{1, N}, \text{ then } (t_d = t_1 + \dots + t_N) \quad (8)$$

The generated productive rule allows selecting, checked up in a certain interval of time, arguments.

Based on the given arguments there is a possibility of simplification of structure of the knowledge base and elimination of repeating elements. Proceeding from the above-stated, the algorithm of abbreviation of intersected algorithms is offered at formation of the knowledge base [7].

#### IV. ALGORITHM OF INCREASE OF EFFICIENCY OF DECISIONS

Proceeding from the above-stated, with a view of effective formation of a decision tree based on information resources of the information systems oriented on control, and the organization of process of search in them, formation of the following knowledge base also is considered a question of development of alternatives of the decisions promoting decision-making.

Proceeding from the above-stated, with a view of effective formation of a tree of decisions based on information resources of the information systems focused on management, and the organization of process of search in them, formation of the following knowledge base also is considered a question of working out of alternatives of the decisions promoting decision-making.

The algorithm of creation of the knowledge base of the information systems directed on increase of efficiency of alternatives of decisions in information systems, is resulted on fig4. In this algorithm after formation initial R a rule generated by means of inquiries, it is analyzed by means of a tree of decisions (1) and Q a search engine (2), it is checked on the contradiction  $z_i$ . As a result of a negative condition after check diagnostics of errors is spent. If the

contradiction is not eliminated, the rule leaves. In a case if, check has yielded positive result, the secondary analysis is carried out and check on errors is again carried out. At negative result, diagnostics process is started, measures on elimination of contradictions are taken. If there is no its possibility to eliminate, the rule leaves. After positive (*satisfactory*) result measures on elimination or generalisation of simple rules on the basis of values of an expert estimation are realised. After that the status (*rank*) is defined and its record in the knowledge base is carried out. At performance  $R_i \in R_n$  conditions of a complex of formed rules the knowledge base of information system registers. Otherwise for rule addition iterative process proceeds.

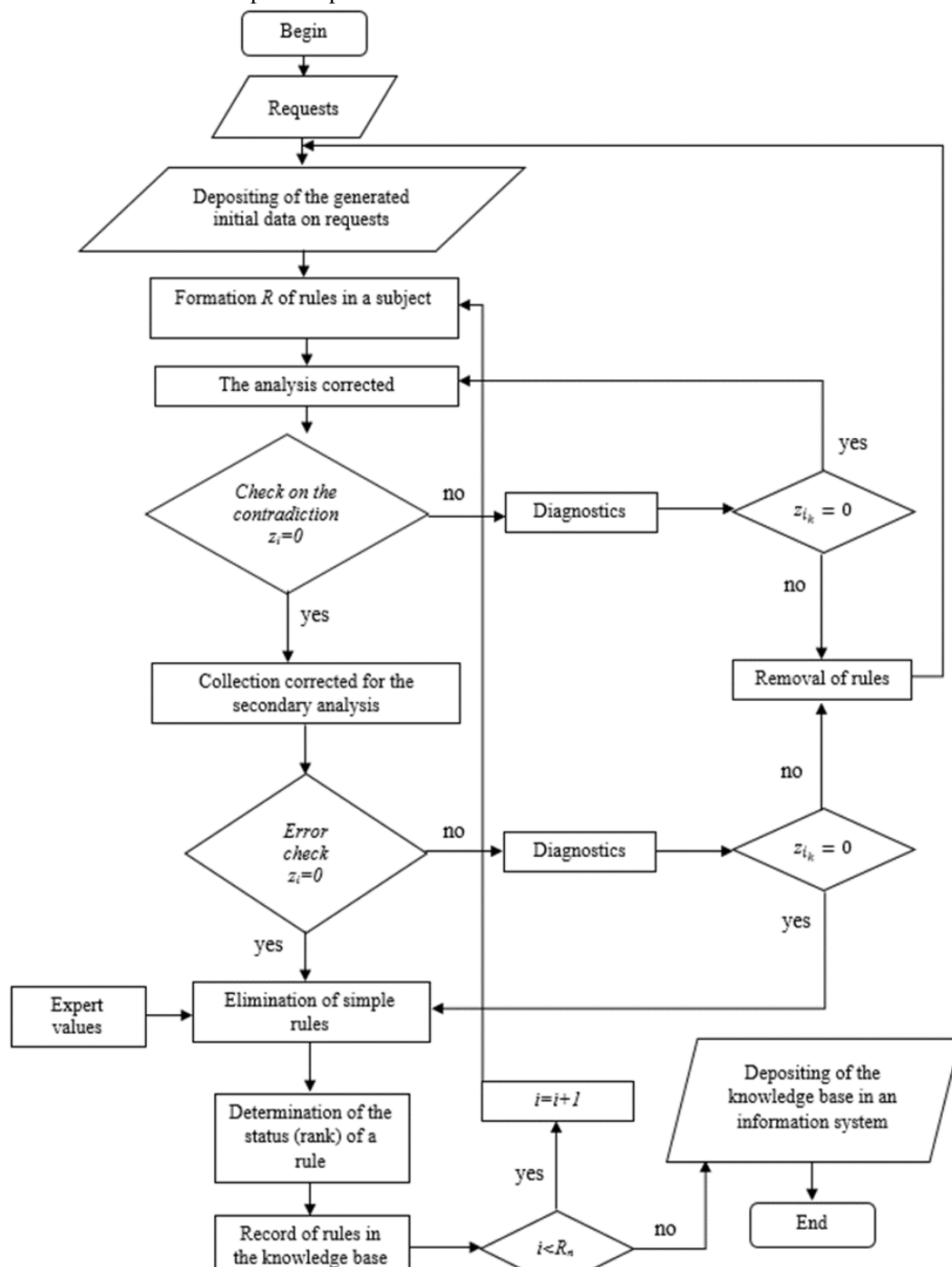


Fig4. Algorithm of formation of the knowledge base of the information systems directed on increase of efficiency of alternatives of decisions in information systems



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## V. CONCLUSION

Now in connection with increase in base of electronic information resources in the organization's state and an economic board it is required to carry out work with the big data files, correctly to organize process of their management [1,3-7]. At realization of the operative and effective analysis of such great volume of the information of an insufficiently actually modern information-communication infrastructure. Creation and introduction in the given infrastructure of modern software of the analysis is expedient. It in turn, will allow forming correctly alternatives of the decisions promoting decision-making, management being the basic mechanism. At data processing, it is applied to a finding and elimination of contradictions in an information resource of a tree of the decisions based on production of model.

In research the approach and the algorithm possessing in potential of a superstructure of information system, the knowledge base directed on formation for the model, the quantity of errors focused on decrease in decisions are offered, to model of a tree of decisions for decision-making in management, and also the full organization of process.

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