Decision-making systems and criteria

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ABSTRACT

Decision support systems and the discovery of hidden knowledge and logical decision criteria based on decision rules and precedent are reviewed.

Keywords: Hidden knowledge, data mining, informative symptoms, latent symptoms, neuron systems, precedent.

As a result of the improvement of computer technologies and their penetration into almost all spheres of society, data bases of various categories (BB) are constantly growing on a gigantic scale. Among those given, there may be those who do not contribute to the desired result. In this case, working with given materials requires a lot of resources. At the same time, there is a growing demand for methods that can discover "hidden knowledge" from this astronomical amount of "raw" data. Because "hidden knowledge" cannot be extracted using special query languages created for traditional BBs (for example, SQL query language for relational BBs). "Hidden knowledge" means:

- previously unknown, that is, new knowledge;
- knowledge that cannot be seen directly (for example, for direct visual analysis of data or calculation of simple statistical descriptions);
- knowledge which is useful for practice, that is, valuable for a researcher or consumer;
- it is necessarily vital to have knowledge that can be easily explained, that is, knowledge that can be easily explained through terms in the field of science.

These requirements define the nature of Data Mining (DM) methods and how DM technologies look and interact with BB management systems, statistical analysis methods, and artificial intelligence methods.

It is accepted to represent the knowledge discovered using DM methods in the form of a model. Such models include associative rules, decision trees, clusters, mathematical functions. Methods of building such models are seen in the field of artificial intelligence.

Problems to be solved by DM methods are divided into descriptive and prognostic ones. The most important thing in descriptive questions is to give a clear description of existing hidden laws, while in predictive questions, it is to forecast future events based on what is given in the selection.

Descriptive issues include:

- search for associative rules or images;
- grouping of objects, cluster analysis;
- building regression models.

Forecasting issues:

- object classification (for predefined classes);

- regression analysis, time series analysis issues are included.

Solving the problem by DM methods consists of the following steps:

1. Forming a hypothesis;
2. Collection of givens;
3. Data preparation (filtering);
4. Selection of models;
5. Selection of model parameters and training algorithm;
6. Training the model (automatic search for the remaining parameters of the model);
7. Analysis of teaching quality, if unsatisfactory, returns to step 5 or 4;
8. Analyze the detected pattern, if not, return to step 1, 4 or 5.

DM technologies have the following problems:

- Giant inputs: Among the inputs, there may be some that do not contribute to the desired result. Working with givens in this case requires a lot of resources;

- Error-measured inputs: In DM methods, achieving the intended goal depends on how accurate and reliable the inputs are. Errors in the measurement of data have a negative effect on the result;

- Unmeasured parameters: For some reason, some symptoms in the parameters may remain unmeasured (for example, the patient may not have enough money for all the analysis, or the measuring device may be broken, etc.);

- Givens of different categories: In real life, the signs of objects are of different categories (quantitative, nominal, binary and ordinal), and working with them creates its own problems;

- Selection of informative symptoms: Among the symptoms of objects in the selection, there may be those that repeat each other or do not affect the obtained result. Excluding such non-informative symptoms from the selection increases the quality of the model and saves resources in the processing of data. However, the complexity of the issue of sorting symptoms is combinatorial in nature. Therefore, one of the modern problems of DM is to find methods that reduce the complete sorting (enumeration) in the selection of symptoms;

- Finding latent symptoms: Latent symptoms are hidden symptoms that result from a certain combination of symptoms present in the selection. The symptoms in the selection may not always be sufficient for decision-making, in such a situation, a new symptom space is constructed with the help of latent symptoms and the problem is solved. The problem of finding informative latent symptoms is not fully resolved;

- Find reference objects: When working with giant selections of various categories, find reference objects that fully cover the selection and the minimum number of reference objects.

DM technologies are rapidly entering almost all spheres of human activity. Originally used in banking, insurance, e-commerce and e-marketing, it has now been used in other fields such as industry, financial analysis, web resource and text analysis, public sector, biology, genetics, medicine and natural sciences. is also used. Social network analysis, anti-terrorism and mobile network analysis, stock exchange, seismology are providing effective results. Therefore, the advanced countries of the world are attracting large funds and experts to the development of DM technologies.

Decision support systems in collaboration with users are divided into the following three types:

- Direct active participation in the development of the right solutions;

- Passive participation in the decision-making process when a certain impossible offer is put forward;

- A decision support system requires a cooperative relationship with users. The previously pushed comment is processed in the system and sent to the user for verification, after which the system completes the work.

A decision-making system helps the user to make a choice. A decision-making system uses different methods to analyze the data:

- search for information,
- intellectual analysis of givens,
- search for knowledge from the given database,
- reasoning based on precedent,

- simulation modeling,
- evolutionary computing and genetic methods,
- neuron networks,
- situational analysis, cognitive modeling, etc.

A certain number of questions must be answered in order to make a decision. For this, it is necessary to organize a question-and-answer process between the parties. In Buyer, the question-and-answer process can be organized in two ways: the number and meaning of the questions are recorded (for example, psychological tests), when each subsequent question is determined based on the answer to the previous question. From the point of view of automating the ECM question-and-answer process, option 2 is interesting because of its "thinking" elements.

An intellectual system is a technical or software system that has the ability to solve traditionally considered creative problems, and its memory stores knowledge related to a specific subject area. The system includes three main blocks - a knowledge base, a problem solving block and an intellectual interface.

Formation of the knowledge base component in artificial thinking systems is one of the important issues. Expert systems can be examples of systems where knowledge is openly described. In the structure of the expert system, two components - the knowledge base and the logical inference mechanism - play the main role. In a field, knowledge is represented in some chosen formalism, and based on the given facts, a logical inference mechanism reproduces the knowledge and draws conclusions.

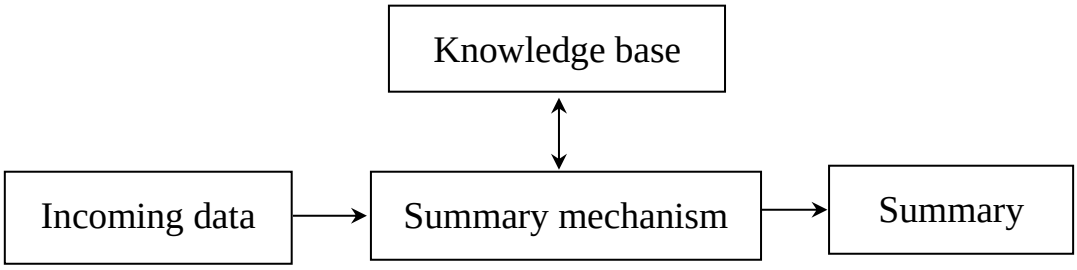

Figure 1.1. Functional diagram of a knowledge-based system

It can be said that the quality of knowledge-based systems is determined by the size and quality of the knowledge base.

The system works in the following repetitive order:

- selection of analysis results or data (request);
- observations, interpretation of results;
- creating new information using rules;
- creating temporary hypotheses

The process stops when there is enough data to make a final conclusion.

At the modern level of development of information technologies, more precisely, the logical decision-making system from knowledge in the decision-making support system has a development direction of logical decision-making systems based on:

- Rules;
- To precedents.

Almost all large decision-making expert systems are rule-based logical decision-making systems, modeled as strictly deductive processes. The content of this is that a set of "IF...THEN..." type rules is introduced into the system, where a conclusion is made on the issue of interest based on the incoming data. Together with selected model-building experts, it was the basis for the creation of the first generation of expert systems that were convenient enough for expert users, but over time it became clear that the deductive model is the most rarely applicable to solving expert problems, models the type of problems. The idea of rule-based decision making is important. Because it means the existence of clearly formalized problems that have proven their applicability and have scientific methods that allow obtaining a solution that does not require proof.

Building such a model of solving problems based on experiences led to the emergence of logical decision-making technologies based on precedents (English -

Case-Based Reasoning or CBR), and later allows the emergence of software products that implement this technology.

In a number of situations, precedent-based decision-making methods have many advantages over rule-based decision-making methods. In particular:

- When the main source of knowledge about the issue is not theory, but experience;
- When solutions are not unique for a specific situation and are used in other cases;
- When the goal is not a guaranteed correct solution, but a range of possible solutions.

Thus, decision-making methods based on precedents represent a method of creating expert systems that draw conclusions about a given issue or situation based on the result of a search for similarities stored in the database of precedents.

References:

1. Potapov A.S. "Technologies of artificial intelligence" - St. Petersburg State University ITMO, 2010. - 218 p.
2. Ignatev N.A. “Combination of general indicators and data mining” // Automation and telematics. 2011, No. 5. pp.183-190.
3. Ignatev N.A., Madrakhimov Sh.F. “Stability and generalized evaluation of classified objects in a heterogeneous feature space” // Wichesl. Technologies 2011.V.16, No.2. pp. 70-77.
4. Granichina O. A. “Mathematical models of quality control of the educational process in a university with active optimization” // Stochastic optimization in informatics. - St. Petersburg: Publishing House of St. Petersburg State University. 2006 VIP. 2. S. 77-108.
5. Ignatev.N.A., Adilova. F.T., Matlatipov G.R., Chernyshyu P.P. “Knowledge Discovering from Clinical Data based on Classification Tasks Solving” // MediNFO. - Amsterdam: IOSPress, 2001, 1354-1358.
6. Ignatiev N.A., Nurjanov Sh.Yu. "Artificial Intelligence Systems" // Tashkent 2014 C.69