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DEVELOPMENT OF THE RULES BASE FOR AN EXPERT SYSTEM CHOICE ADAPTIVE LEARNING STRATEGY

Andrey Vladimirovich Ostroukh[1], Dmitry Ivanovich Popov[2], Dmitry Grigorievich Demidov[2] and Nataliya Evgenievna Surkova[1]
[1]Department of Automated Control Systems, State Technical University-MADI, Leningradsky prospect, 64, Moscow, Russian Federation
[2]Moscow State University of Printings Arts (MSUPA), Pryanishnikova, 2A, Moscow, Russian Federation
E-Mail: ostroukh@mail.ru

ABSTRACT

In this article is described rules data base creation method for selection an optimum education path for employees. Rules are formed on the basis of the intellectual data analysis of open education Institute MSUPA by Ivan Fedorov. Those data contains information about students' education results with applied remote educational technologies for 10 years. This analyses shows both the most successful and most negative educational method, which could be used by another students by definition others education strategies. Analyses showed the studying sequence of disciplines education plan directly connected with students' education productivity. Therefore expert system, based on received data will be indispensable tutor's instrument and helps to automatize support process of electronic education.

Keywords: expert system, data mining, educational strategy, electronic education.

1. INTRODUCTION

Now Internet integrates into already each sphere of mankind and opens new possibilities for us and for education. Now the best type of education is education during the work. Such approach is useful because of shortage of money and human recourses, way which business is running, lack of flexible schedule [1 - 17]. Above mentioned preconditions are why electronic education is the most preferable, which develops everywhere.

Electronic education constrains of education and testing - the main form of control in electronic educational systems. The principle is: student gets subjects list have to study and educational content. Sequence for education student chooses independently (Figure-1).

Because of information flow growth, technologies develop and knowledge deepening one education method for each education forms and for each student is reason why education constantly getting down and why students acquire information worse.

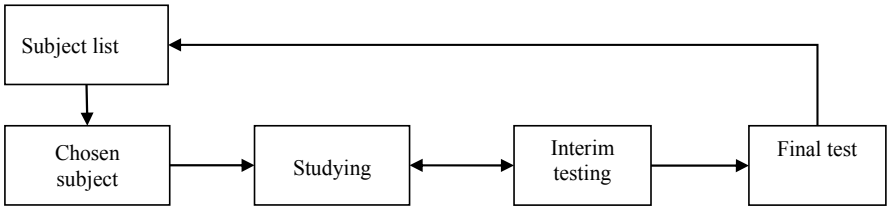


Figure-1. Classical principle of electronic education.

2. EXPERT SYSTEM DESCRIPTION

One of the method how to solve this problem is to provide for the student expert system which allows make the most successful education strategy according to preset production model (sequence, Figure-2).

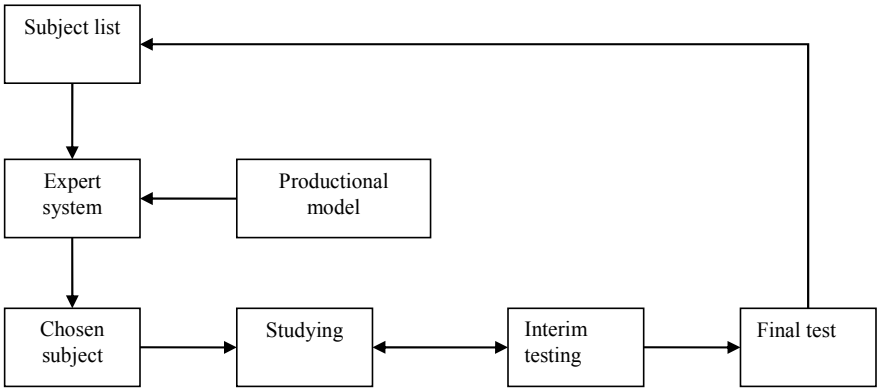


Figure-2. Electronic training with using expert system.

Expert system - computer system capable partly replace expert by solving problem. Function principle of expert system allows user to enter in system facts or some information and get as a result expert knowledge. In structure (Figure-3) expert system has database and inferencing engine.

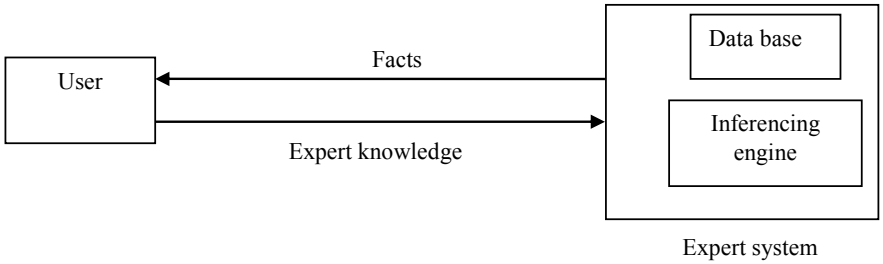


Figure-3. Basic functioning principles of expert system.

Database contains rules which inferencing engine uses to form conclusion [4].

The main task expert system is provide to student opportunities for input as factors list of disciplines and other parameters for their analysis and for making conclusion in the form of recommendations how to prepare education strategy.

3. DEVELOPMENT OF PRODUCTION MODEL

There is production model as a database in expert system, based on rules and allows to give knowledge in form of implication "If (condition) then (action)" [2].

In case of electronic education source for productional knowledge is database with test sessions of Institute for open education MSUPA which contains 650,000 records.

To form productional rules first of all is necessary to make intellectual data analysis using Data mining [3] to receive knowledge for understanding and classification in convenient form. Common analyses principals showed on Figure-4, they mark target data (used in following analysis), their preliminary processing (to clean noise, reduction in convenient form for analysis), make analyse and show result.

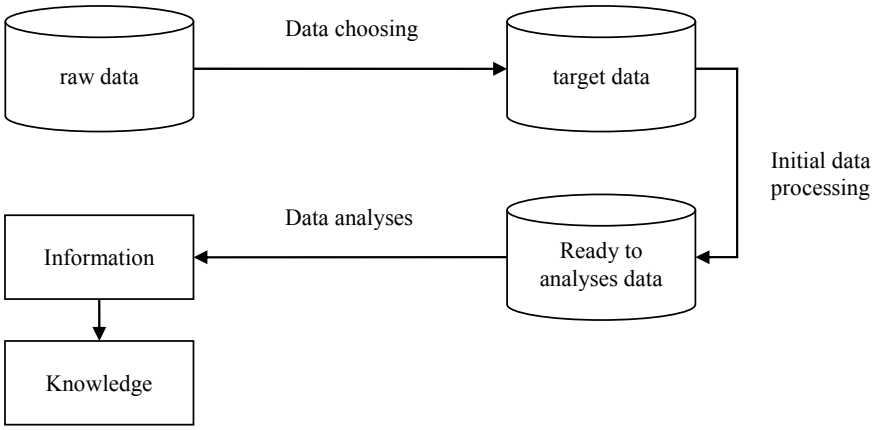


Figure-4. Intellectual principle data analysis.

Intellectual data analysis using methods of classification, clustering, correlations, regressions, prediction, the analysis of sequences, variance analysis [3] is capable to give effectively answers to questions. Tasks solved by Data mining is possible to separate on descriptive and predictive. In descriptive tasks most important is to give evident description of the available hidden regularities, in predictive tasks is important question about prediction for cases without any information [5]. Compilation of productional rules belongs to the descriptive task.

To solve descriptive tasks is more effective use clustering, classification, correlations, deviation methods and in certain cases sequence analysis. Using data analysis algorithms which are typical for the solution of described methods, leads to receiving explicit knowledge which are able to be entered in expert system production model in form of productional rules.

Intellectual data analysis was realized with using Microsoft SQL Server DBMS 2008 R2. After preliminary processing database contains testing results of students for 2004-2013 and 474, 000 records. Except of testing results in database was entered information about specialties and the education directions, disciplines, groups and students. Process of intellectual analyses was realized using Microsoft Business Intelligence Development Studio (BI Studio), created for work with SQL Server. Analyses was realized in different directions using simplified Bayes algorithm, decision tree algorithm, clustering, sequence clustering in neural network. Database from BI Studio showed on Figure-5.

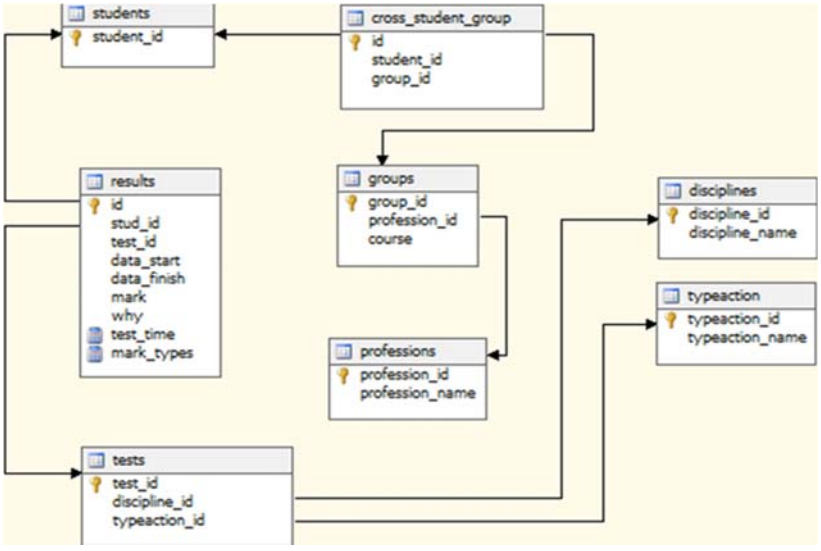


Figure-5. Data base structure.

4. RESTRICTIONS

But it cannot be used for analyses in such form because there are restrictions in Data Mining algorithms. Besides there is a problem how to reflect and perceive results. To solve these problems were used methods of submission BI Studio, which allow create new using old tables and add attributes in existing essence using simple SQL-query. Original database is not changing. In BI Studio were changed:

- was created submission includes full list of students and groups, speciality and course;
- were united tables of test result, subjects and test type (final, interim), was added time attribute;
- were separated final test results;
- was created table with periods of subjects studying, contains a lot of additional attributes, e.g. number of test sessions for one subject in particular period, average mark.

5. CONCLUSIONS

As a result data base modification allows more flexible use initial data, avoids limitation of Data Mining algorithms and solves problem during interpretation of analyses result.

Test system data base analyses provided next results:

a) Disciplines ranking (Figure-6) which allows define mark probability in all disciplines.
b) Evaluation time used for test (Figure-7). This result allows evaluating time extended for learning particular discipline and chooses cluster based on mark.
c) Average time evaluation, number of test session and getting mark in each discipline (Figure-8). This result allows evaluate discipline difficulty.
d) Dependence between mark and number of attempt (Figure-9), which helps to discover cases when data base was cracked.

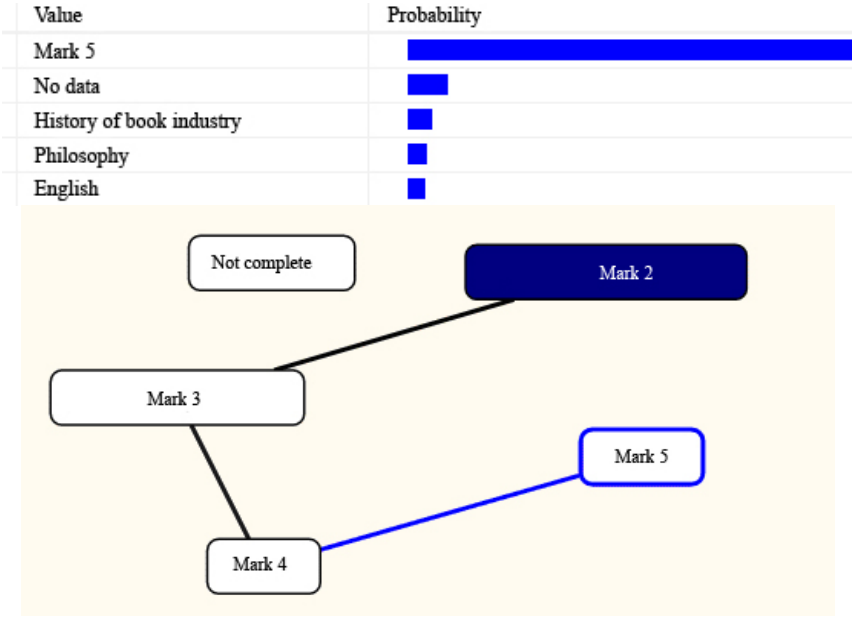


Figure-6. Disciplines ranking.

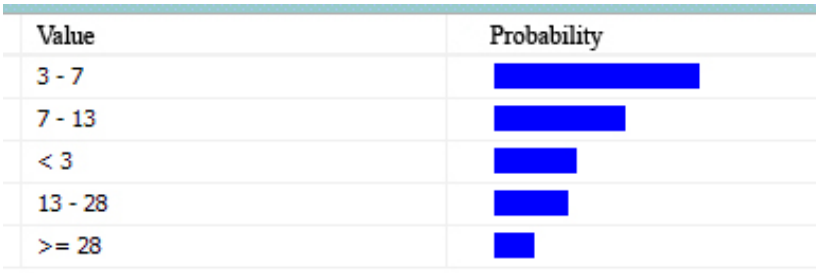
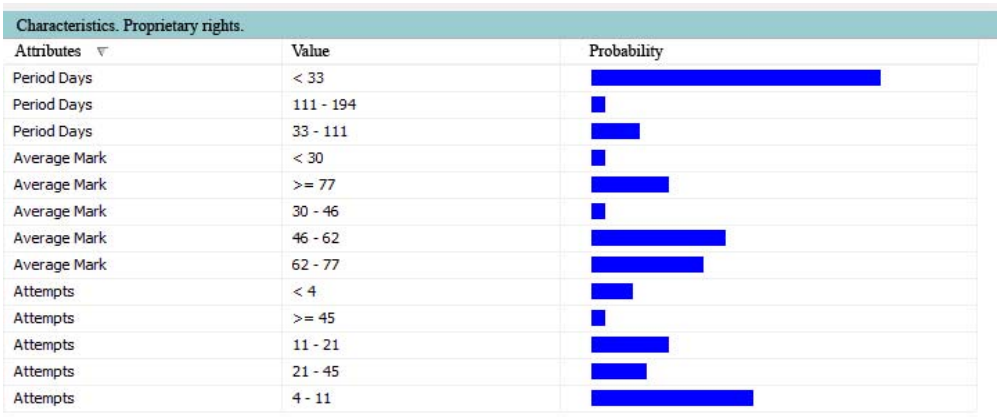


Figure-7. Expended time for test.



Characteristics. Proprietary rights.

Attributes	Value	Probability
Period Days	< 33	
Period Days	111 - 194	
Period Days	33 - 111	
Average Mark	< 30	
Average Mark	>= 77	
Average Mark	30 - 46	
Average Mark	46 - 62	
Average Mark	62 - 77	
Attempts	< 4	
Attempts	>= 45	
Attempts	11 - 21	
Attempts	21 - 45	
Attempts	4 - 11	

Figure-8. Discipline difficulty evaluation

= 86

	Value	Probability
eriod(Jurisprudence).Attempts	21 - 45	

Figure-9. Discipline difficulty evaluation.

For development of productional rules it is offered to use existing sequences of disciplines studying. Discovering disciplines study conformity by stable students' progress make possibility to form data base with rules for expert system. Input data here will be list of disciplines, output data will be recommendations what education strategy should be chosen.

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