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ONE APPROACH FOR DETERMINING THE FINAL EVALUATION CRITERIA FOR INSTITUTIONAL ACCREDITATION OF A HIGHER SCHOOL THROUGH INTELLIGENT DATA PROCESSING

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Abstract: *In this article we will develop a method for determining the final evaluation criteria for institutional accreditation of higher schools (HS) that contains precise instructions for determining the evaluation for each indicator in group criteria and automated form the final score of criteria through intelligent data processing.*

Keywords*: data mining, intelligent data processing,evaluation, accreditation, SAS Enterprise Miner*

INTRODUCTION

Intelligent data processing is a process of discovery in unstructured raw data of unknown, non-trivial useful for practice and affordable interpretations of knowledge required for decision making in various areas of human activity. The main goal of intelligent data processing is to extract different conclusions (reasoning) and new knowledge from existing unstructured or poorly structured data (raw data) [3].

The most common categorizing the types of variables in intelligent data processing is:

- Scale. It refers to the variables measured by relative or interval scale (age in years, income in the currency, weight in kilograms, etc.). This is the strongest type of scale, i.e. it enables full use of all statistical indicators.

- Ordinal. It refers to the variables measured on an ordinal scale or rank. This type of scales contain quantitative gradation, but the gap between different levels of scale cannot be accurately determined.

Examples of this are scales like:

1) Approve all, approved in part, partially disapprove, disapprove all;

2) First, second, third, etc.

- Nominal. It refers to variables that are distinguished only by quality varieties of a given attribute (e.g. variable gender, with its meanings man and woman). With this type of scales numerical values of the variable are being used merely as symbols, i.e. have a nominal character [2].

For the purpose of the study, we choose to use for example software SAS Enterprise Miner 1.12 TM, which simplifies the process of data mining, which allows the creation of very accurate predictive and descriptive models of an analyzed base. It is among the market leaders and is designed to make the whole process of intelligent data processing. The software provides access to a rich set of related and detailed data warehouses.The basic language of SAS provides unsurpassed ability to collect and transform data.SAS Enterprise Miner 1.12 TM can support preparation of virtually any type of models.Functions are organized in a process called SEMMA as follows [1]:

- Sample
- Explore
- Modify

- Model
- Assess

INPUT AND OUTPUT DATA SETS IN SAS ENTERPRISE MINER

Because the SAS Enterprise Miner TM aims exploration of very large data sets, all models of prediction are designed for individual training, validation and test sets. The module Date Partition node provides a convenient way for the separation of single data sets into three subsets using random samples (models), stratified random patterns or the use of defined ones.Each tool for making prediction model also allows you to assign a fourth set of data so that it does not require the target variables.These four different uses of the data sets are called roles of the data set.For the training, validation and test data set, tools for predicting can produce two output data sets: one containing the original data and results (predicted values, residuals, the classified result, etc.), the other contains various statistics relating to fit the model (error function, misclassification, size, etc.).In the result set, only the output data set containing the results can be obtained [5].

Measurement level

One of the several ways in which the properties of numbers may affect the properties of the objects. The most common types of evaluations are nominal, ordinal, interval, logarithmic space, absolute values, etc. [3].

Types of data inSAS Enterprise Miner:

- Binary: contains two disparate values (for example, The annual reporting documents of the HS have a section on quality of education during the reportingperiod, THERE: Yes, No).
- Interval: contains values that change in a continuous range (for example, Share (in %) of habilitated,RESULT: 70…..90).
- Nominal: contains various values which have no logical sequence (for example, CRITERIA: International activity, Compliance with copyright, etc.).
- Ordinal: contains various values that have a logical sequence (for example, Sufficient share of courses created in the last 3 years in terms of total courses in randomly selected programs, RESULT: high, insufficient, low).
- Unary: contain a single value (for example, Results of the research activities of students and postgraduates, RESULT: 60).

Due to the heterogeneous nature of the criteria, it is impossible to create a single method for all of them. For this reason, we will classify them into groups, later, for each of them we will develop a different method.

In Table 1 we have clustered them into three groups: qualitative, quantitative and qualitative-quantitative criteria. In group quantitative criteria we included those for which the measurement result is a unary type of data - a single value. In group qualitative criteria we put such whose measurement result is of binary type, i.e. the existence of a document or event. Quantitative-qualitative group includes criteria for which measurement result is a mixed value of type binary and ordinal data, i.e. determining the existence of a document or event and examination the effect of this event or how quality is the existing document.

Table 1. Classification criteria for institutional accreditation[9]

Qualitativecriteria	Quantitative criteria	Quantitative-qualitative criteria
1.1.1.1. Official, institutional texts, in which mission, goals and objectives are clearly defined	1.4.2.2. Access to libraries, the opportunity to work with computers, special offices and labs	1.1.2.1. Availability in the higher school's training records of a clear connection with its declared purposes under 1.1.1. mission, goals and objectives of HS in a way that meets the characteristics of the relevant studies
1.1.1.2. Annual review on the achievements of the mission, goals and objectives	1.5.1.1. Assessments of professional fields and majors from the regulated professions	1.2.2.1.Analyses of course documentation
1.2.1.1. Standards for drawing up documentation (curricula and programmes) for training in the relevant degrees	2.1.2.2.A.Financial policy for the development of research in HSs	1.2.3.1. There is published a formal system for conducting testing procedures (including state exams and thesis defence) to verify and assess the acquired knowledge and skills of students
1.2.1.2.Administrative control over the state of academic records	2.1.2.3.A. Research activity of full-time faculty members	1.2.4.1. Discussion of the state of the system at least once a year
1.2.2.2. Opinions of students and other stakeholders	2.1.2.2. B.Financial policy for development of research, artistic, performing and sporting activities in the HS	1.3.1.1. Clear view of the HS for the quality of education
1.2.2.3. Standard (Procedure) for changes in academic records	2.1.2.3.B. Scientific research, artistic, performers and sports activities of full-time faculty members	1.3.1.2. Operating quality assurance system of education in the HS
1.2.3.2. Administrative control over systems' functioning	2.2.1.2.A. Results of the research activities of students and postgraduates	1.3.1.3.Functioning of internal quality assurance system of education in the HS
1.2.4.2. There is provided a possibility of measuring students'	2.2.1.2. B.Results of involving undergraduates and PhD students in	1.4.2.1. Optimal administrative services

[9]The names of criteria are taken from Criteria system for institutional accreditation of higher schools NEAA

opinion	research creative, artistic and sports activities	
1.3.2.1. Assessment of the state of quality of education in the HS	3.2.2.1.Full-time faculty with academic rank	2.3.1.1.A.Quality publications and productions
1.3.2.2. Improving the quality of education in the HS and enhancement of the quality assurance system in education in the HS	3.2.2.2.Part-time faculty with academic rank	2.3.1.1.B.Quality publications, productions and sports scores
1.4.1.1. Available sources of information to students on courses offered by universities and opportunities for development		3.3.1.1.Own physical, technical, and information facilities have been set up
1.4.3.1.Established practices to help disadvantaged students		3.3.2.1. Completeness of the information base in the HS: - library; - computer facilities; - information centers- computer system for management of administrative and academic activity; - distance learning centre (at accreditation of distance learning programmes)
2.1.1.1.A. Opportunities for involvement of teachers in research activity		4.1.2.1.Contemporary methods and forms of instruction methods and forms of instruction
2.1.2.1.A.Conditions for involvement of lecturers in research activity. Officially announced priorities and objectives of the research activities according to the specifics of the HS		4.1.2.2.Relevance of the proposed tutorial
2.1.3.1.A.Control over the research activities of faculty		4.2.3.1. Information on implementation
2.1.3.2.A.Publicity of faculty's research activities		4.3.1.1. Participation of full-time faculty in national and international educational and research projects

2.2.1.1.A.Opportunities for involvement of students and doctoral students in research activities		4.3.1.2. Exchange of lecturers, undergraduates and PhD students with other universities and organizations abroad
2.3.1.2.A.Compliance with copyright		4.3.2.1. An organization to maintain and develop cooperation with other universities and organizations has been established
2.1.1.1. B.Opportunities for involvement of lecturers in research and / or artistic, performing and sports activities		
2.1.2.1. B.Conditions for research and / or artistic, performing and sports activities of academic staff. Officially published priorities and goals of science research, artistic, and sports activities, according to the specifics of the HS		
2.1.3.1.B.Control over the scientific and research activities, artistic performing and sports activities		
2.1.3.2. B.Publicity of the scientific and research, artistic, performing and sports activities of faculty		
2.2.1.1. B.Opportunities for involvement of undergraduates and PhD students in research, creative, artistic and sports activities		
2.3.1.2. B. Compliance with copyright		
3.1.1.1.Legislation		
3.1.1.2.Organizational regulations		

3.2.1.2.Career development of full-time academic staff in the HS is an integral part of its status and is publicly available		
3.2.3.1.PhD students and postgraduates at the HS		
4.1.1.1.Presentation of innovative results		
4.1.1.2.Innovative research		
4.2.1.1. Analysis of the environment and the formation of an adequate policy of the HS		
4.2.2.1.Knowledge of labor market state		
4.2.2.2.Knowledge of the employers' standpoints		
4.3.3.1. Projectsand results of scientific services to businesses and government		

After we classified criteria into 3 groups now we should develop a method for determining the evaluation for each one of the groups.

Experts use two types of evaluation: quantitative and expert. Quantification is shown in the table for assessment of institutional accreditation of higher education (e.g. 3.2.2.1.). In the cases where quantitative evaluation cannot be applied, the experts decide on one of the following ways: ***There is, there is no or there is insufficient compliance with the criteria*** and depending on that they specify points, withinthe prescription for the certain indicator:

• If there is compliance, they award the maximum number of set points;

• If there is no compliance,points are not awarded;

• If there is insufficient compliance, points are awarded at the discretion of the evaluators.[4]

We will use intelligent data processing to form an evaluation without subjectivity of the expert group.

A METHOD FOR DETERMINING THE ASSESSED IN THE GROUP QUANTITATIVE CRITERIA

For example, we choose criteria „3.2.2.1. Full-time faculty with academic rank".The maximum score for this criteria is 6 and is formed by two indicators whose data type is an interval.

Indicator "Share (in %) of habilitated full-time faculty who read lectures." The measured result is estimated as follows: From 70 to 80-2; From 81 to 90-3; Over 91-4.

Indicator "Average age of habilitated full-time faculty who read lectures."The measured result is estimated as follows:Till age of 55 - 2; Till age of 65 - 1.

It is necessary for an automated quality management system of an HS to maintain information for the full-time faculty of the, which is updated annually to increase the age of each faculty with 1 and remove retired and left the faculty. In such a case it is possible for evaluation criteria 3.2.2.1. tobe formed automated.

A METHOD FOR DETERMINING THE EVALUATION IN QUALITATIVE CRITERIA GROUP

In the qualitative evaluation, it is necessary to first determine the type of data measured result and after that indicators needs to decompose. Let's take for example criteria“4.2.2.1. Knowledge of labor market state“.The maximum score for this criteria is 1 and is formed by 2 indicators whose data type is binary.

Indicator “Study of the labor market condition and the trends of its changes.” Measured result: Yes / No - 0.5.

Indicator “Use of statistics in planning the policy of the HS for the guidance of undergraduates and Ph.D. students in their choice of educational programmes and research topics." Measured result: Yes / No - 0.5.

In the case of a correct evaluation of this criteria through intelligent processing it is appropriate to decompose indicators to 4 as follows:

1. Indicator “For each specialty of the HS studies the labor market.” Measured result: Yes / No - 0.25.

2. Indicator "Every year there is a study on the labor market." Measured result: Yes / No - 0.25.

3. Indicator "What is the% of graduates started working in the same specialty." Measured result: From 50 to 100 - 0.25.

4. Indicator "Are there measures taken to enhance% of graduates started working in the same specialty." Measured result: Yes / No - 0.25.

In this way can easily determine how many of these indicators satisfies the given HS and to form an evaluation of this criteria. Suppose that an HS meets the indicators 1.2 and 4, respectively, it will receive 0.75 evaluation on this criteria.

A METHOD FOR DETERMINING THE EVALUATION IN GROUP QUANTITATIVE-QUALITATIVE CRITERIA

This type of criteria describe whether an event has happened, but also to what extent the results are satisfactory. Indicator, whether the event happened, is a binary data type that can easily measure.Data on the degree of satisfaction with the results are of the ordinal type: there is, there is no or there is insufficient compliance with the criteria.To determine this degree again we need to decompose indicators and evaluate them individually (as in the method of qualitative evaluation) and then as a sum to form the final result.

Let's take for example criteria “1.1.2.1. Availability in the higher school’s training records of a clear connection with its declared purposes under 1.1.1. mission, goals and objectives of HS in a way that meets the characteristics of the relevant studies“.The maximum score for this criteria is 3 and is formed by one indicator“It reflects the implementation of these characteristics in the officially adopted academic records of training.“ with measured result 3. Data for this indicator are type rated for which at this stage we cannot automate measure the result. It is, therefore, necessary to decompose this indicator to 4 ones of binary type and form result as follows:

1. Indicator “There is a reflection of the mission, goals and objectives of HS in the qualification characteristics of each specialty.” Measured result: Yes / No - 0.75.

2. Indicator “There is a reflection of the mission, goals and objectives of universities in the curricula of all specialties.“Measured result: Yes / No - 0.75.

3. Indicator “Knowledge, competencies and skills that students acquire are reflected in the qualification characteristics and content of the curriculum. “ Measured result: Yes / No - 0.75.

4. Indicator "Qualification characteristics and content of curricula are updated in accordance with the requirements of social practice and the Ordinance on uniform state requirements for acquiring EQD "Bachelor"and EQD"master."" Measured result: Yes / No - 0.75.

If an HSresponds with "Yes" to indicators 1 and 2, it will receive an automated measured result 1.5 on this criteria.

CONCLUSION

Based on the experiments in this study we can draw the following conclusionsto develop a method for automated evaluation criteria with one or more indicatorswe need to:

- pre-determine the type of criteria as: qualitative, quantitative and qualitative-quantitative;
- to determine the type of data measured result according to the selected tool for intelligent data processing;
- to decompose indicators of simpler conditions that can measure with a scale.

In the study, we developed three methods, one for each type criteria, for all other criteria can be established methods for evaluation by analogy.

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ЕДИН ПОДХОД ЗА ОПРЕДЕЛЯНЕ НА КРАЙНАТА ОЦЕНКА НА КРИТЕРИИТЕ ЗА ИНСТИТУЦИОНАЛНА АКРЕДИТАЦИЯ НА ВИСШЕ УЧИЛИЩЕ, ЧРЕЗ ИНТЕЛИГЕНТНА ОБРАБОТКА НА ДАННИ

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***Резюме**: В настоящата статия ще разработим методика за определяне на крайната оценка на критериите за институционална акредитация на висше училище (ВУ), която съдържа точни указания за определяне на оценката по всеки показател в дадена група критерии и за автоматизирано формиране на крайната оценка на даден критерий, чрез интелигентна обработка на данни.*

***Ключови думи**: извличане на данни, интелигентна обработка на данни, оценяване, акредитация, SAS Enterprise Miner.*

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