A New Method For Assessment Of Colleges By Naac/Nba Criteria Based On Rough Set Theory

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Abstract - Higher educational institutions are facing a global competition in terms of low graduation rates and less employability. An important characteristic in an educational institution is to make better accurate and objective assessment. To enhance and promote quality higher education the autonomous body called National Assessment and Accreditation Council (NAAC) established under the University Grant Commission (UGC) and also National Board of Accreditation (NBA). The NAAC/NBA has designed the different criterion system for the assessment and accreditation procedure. P.Ramasubramanian et al [4] investigated the problem of ranking the professional colleges using partial order generalization of rough set theory. In this paper, the author identifies the Institutional assessment based on the NAAC/NBA assessment criteria by using assessment indices system based on rough set theory.

Keywords*: *Assessment method, NAAC, NBA, OBE, Rough set, Weights.

I. INTRODUCTION

There are thousands of engineering institutions in India. Most of the educational institutions provides huge amount of graduates every year and also produces stresses on professionalism. The quality of engineering education and performance are not satisfactory in most of the engineering institutions due to students' failures in university examinations, unqualified teachers, less placement opportunities, poor infrastructure, poor library facilities and other factors. To improve the quality of education and placement activities, the AICTE and UGC has to monitor the institutions to improve the quality of technical education by getting accreditation (NBA/NAAC). As we advance into 21st century, every management must analyze their institution for assessment. In the current scenario, the quality of professional educational system is based on finances, resources, infrastructure, how to organize, control and deliver education and training, and the outputs primarily focuses on the products or results of education.

In India, the higher educational system is entirely different from other educational system based on the assessment of the educational institutions such as commitment to Program Excellence, the demonstration of excellent student learning outcomes, and the development of a culture of quality. The Program excellence is manifested whether all degree courses offered in the educational systems are accredited and it provides good infrastructure amenities, quality of teaching and learning, quality of professional exposure, research, and creative work, support for students, and relations with the community, research and publications for institutions, creative work and relevant extension programs for colleges; and employability or linkages for professional institutes.

To improve the quality of teaching and learning process of an institution the AICTE/UGC monitor the technical institution via NBA/NAAC. The major parameters followed by NBA/NAAC are Curricular Aspects, Teaching Learning and Evaluation, Research Consultancy and Extension, Infrastructure and Learning Resources, Student Support and Progression, Governance and Leadership, Innovative Practices etc.,

Rough Set Theory(RST) was introduced by Pawlak[3] in the early 80's which is an extension of set theory for the study of intelligent systems. Rough sets are applied in several fields such as medicine, economics, business, environment, computer engineering, and information science. Rough sets are based on set theory and use "lower" and "upper" approximations to describe an unknown data subset.

A.Lower and Upper Approximations

A method to analyze rough set is based on the two basic concepts namely lower and upper approximations. Let U be any finite universe of discourse. Let R be any equivalence relation defined on U. The pair (U,R) is called the approximation space. This collection of equivalence classes of R is called as knowledge base.

Suppose U is a finite and nonempty set called the universe, and let R denote an equivalence relation on U, A = (U, R) is called an approximation space. If x, y ∈ U and (x, y) ∈ R, we say that x and y are indistinguishable, R is called a

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indiscernibility relation. R partitions the set U into disjoint subsets. Such a partition of the universe is denoted as:

$$\frac{U}{R} = \{X_1, X_2, ...X_n\} \quad \text{..... (1)}$$

where Xi is the equivalence class. For any subset X, it may be impossible to describe X precisely using the equivalence classes of R. In this case, one may characterize X by lower approximation $\underline{RX}$ and upper approximation $\overline{RX}$ and is defined by:

$$\underline{RX} = \bigcup \{Y \in : Y \subseteq X\}$$
$$\overline{RX} = \bigcup \left\{ Y \in : \frac{U}{R} Y \cap X = \phi \right\} \quad \text{..... (2)}$$

where x_i is an elementary set contained in X, i = 1,2,…,n.

The ordered pair $(\underline{RX}, \overline{RX})$ is called rough set. In general, $\underline{RX} \subseteq X \subseteq \overline{RX}$. If $\underline{RX} = \overline{RX}$ then X is called exact. The lower approximation of X is called the positive region of X and is denoted by POS(X) and the complement of upper approximation of X is called the negative region of X and is denoted by NEG(X). Its boundary is defined as BND(X) = $\overline{RX} - \underline{RX}$. Hence, it is trivial that if BND(X)= φ, then X is exact.

For any subset R of A, a binary relation IND(P), called the indiscernibility relation is defined as IND(R)={(x,y) $\in U \times U : a(x) = a(y)$ for all a in R}

The degree of dependency of a set of attribute D on a set of attribute S is denoted by, $\gamma_s(D)$, $0 \le \gamma_s(D) \le 1$ and is defined as

$$k = \gamma_s(D) = \frac{\text{pos}_s(D)}{|U|} \quad \text{..... (3)}$$

if $\gamma_s(D)=1$, then S is functionally determines D.

II. LITERATURE REVIEW

P.G. JansiRani and R. Bhaskaran [1] identifies the influence of various factors affecting students' academic performance which is of great importance to educators and parents. This study will facilitate the students to achieve their performance systematically and to have an awakening about their area of deficiency to be strengthened to have the best performance using the Rough set theory. Lisha kong and their collaborates [2] describes the study of assessment method for computer networks security is made by identifying the weights of every index in the assessment index of network security by using the attributes of important degree in rough set theory and they also eliminate the data which are unnecessary for the network security assessment .this method also solves the problems which are established in the traditional methods and provides more accuracy of assessment. P.Ramasubramanian et al [4] describes the ranking of professional colleges by using partial order generalization using RST. This ranking is done based on various measures and parameters. The parameters are derived and they are listed in the form of the ordered Information table. Shinya imai and their collaborates [5] describes human resource management and customer relationship management are important in every corporation. The rough sets theory separates superfluous factors from important elements in our decision table and successfully deals with the human resource and customer relationship management, besides we find out latent logic of features and answers to manage employees and customers. Those useful information can be adopted in IT corporations, to help them to provide right service at right time which satisfies their customers without sacrifices employees' rights, in another word, increases the satisfaction of employees and customers at the same time. Yuting He, Wenjun Shu and et al [6] discussed about the assessment of aircraft structural safety is really a multiattribute evaluation process. Because of many uncertainties induced by the absence and decentralization of safety information, a rough set based model to comprehensive assessment of aircraft structural safety is set up. The author applies this model to the structural safety assessment of the in-service aircraft. It was shown from the results that the model can make the assessment more objective able

In this paper, the author analyze the technical institutions based on the NAAC/NBA criteria and apply the method by using rough set theory. The data collected from various engineering colleges forms the database for our study. When the educational domain is targeted, several factors are to be considered for assessment. Suitable adaptations of relevant theory for model construction and assessment are presented.

III. METHODOLOGY

The authors collected data from JNTUH (Jawaharlal Nehru Technological University – Hyderabad) affiliated institutions. In many information processing systems, objects are represented by their values on a finite set of attributes and it is to be described in a tabular form. The rows of the table correspond to objects of the universe, the columns correspond to a set of attributes, and each cell gives the value of an object with respect to an attribute. Considering the professional colleges, we have taken seven attributes namely Curricular Aspects(C_1) , Teaching Learning and Evaluation(C_2), Research Consultancy and Extension (C_3), Infrastructure and Learning

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Resources(C_4), Student Support and Progression(C_5), Governance and Leadership(C_6), Innovative Practices(C_7). Each attribute may also consist of several sub parameters. For example, attribute C_1 consists of lecture notes, course plan, number of other programs conducted in the department and also the students enrolled in other courses. Similarly, attribute C_2 consist of students enrollment, catering to student diversity, teaching quality, students' performance and satisfaction etc. The NAAC/NBA give more weightage to the attribute C_2 than other attributes. Attribute C_3 consist of innovation eco system, research publication and awards and extension activities. Attribute C_4 includes physical facilities of the institution, library and learning resources and infrastructure, attribute C_5 has students progression and students participation in different activities. Institutional vision and leadership, development, deployment, faculty empowerment strategies and internal quality assurance details are the sub parameters for attribute C_6. Lastly, attribute C_7 consist of social responsibilities, human values, professional ethics and institutional distinctiveness are taken. The overall ranking of an institution is based on all the above seven criteria's. The assessment of objects may not necessarily be the same as the overall assessment of the institute.

A.Indexing system of Educational Institution

According to the AICTE (All India Council for Technical Education) – NBA (National Board of Accreditation)/ UGC (University Grants Commission) - NAAC (National Assessment and Accreditation Council), the assessment criteria of an educational institution depend upon above several factors . These factors can be used as index for the educational grade system. Each system may consist of several sub-components. For example, the campus infrastructure facility consists of land, building, hostel facilities, transportation facilities, electricity, power, backup and telecom facilities etc. Library facility which consists of library space and ambience, timings and usage, availability of a qualified librarian and other staff, Library automation, online access and networking: variety of titles and the volumes per title, National and International Journal available, and above all the digital library facility.

B. Method of Assessment

Considering the data of information table 1, the institutional assessment is based on the RST is as follows:

1. Collect the data and establish the information system of institution assessment S = (U, C, V, f); where U is the set of assessed objects (called universe), C is the set of composed assessment indexes.
2. Record all entries in the assessment form for further processing.
3. Delete duplicate lines of the established information system of institution assessment and make a numerical processing
4. Identify the importance degree of indexed and weights.

The index set A = {a_1, a_2, …, a_m} are the importance degree of attribute set in RST and each index in the system is determined by the following:

$$S_A(a_i) = \frac{|\mathrm{POS}_A(A)| - |\mathrm{POS}_{A-\{a_i\}}(A)|}{|U|} \quad \text{.....(4)}$$

where i = 1, 2, 3, …, m

the weight of index ai is given by $w_i = \frac{S_A(a_i)}{\sum_{i=1}^{m} S_A(a_i)}$

.....(5)

and finally, we can get the institution assessment model which is defined by

$$P_j = \sum_{i=1}^{m} w_i f_i \quad \text{..... (6)}$$

where P_j is the comprehensive assessment value of assessed j^{th} object f_i is the assessment values of i^{th} index a_i. according to the comprehensive assessment value, each object can easily be assessed.

Table 1: NAAC assessment results of the Institution

	C_1	C_2	C_3	C_4	C_5	C_6	C_7
1	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Average
2	Excellent	Excellent	Good	Good	Excellent	Good	Average
3	Excellent	Excellent	Average	Good	Excellent	Good	Average
4	Poor	Good	Very poor	Average	Very poor	Average	Good
5	Average	Average	Poor	Good	Poor	Good	Excellent
6	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Poor
7	Very poor	Very poor	Very poor	Poor	Very poor	Very poor	Poor
8	Good	Good	Average	Excellent	Good	Good	Good
9	Good	Good	Poor	Good	Average	Average	Average
10	Average	Poor	Very poor	Average	Very poor	Poor	Poor
11	Poor	Very poor	Very poor	Poor	Very poor	Very poor	Poor
12	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor

The above table value can be modified as 5,4,3,2,1 which represents excellent, good, average, poor, very poor. The new table is shown below.

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Table 2: Modified information Table

Institutions/Criterion	C_1	C_2	C_3	C_4	C_5	C_6	C_7
1	5	5	5	5	4	5	3
2	5	5	4	4	5	4	3
3	5	5	3	4	5	4	3
4	2	3	1	3	1	3	4
5	3	3	2	4	2	4	5
6	1	1	1	1	1	1	2
7	1	1	1	2	1	1	2
8	4	4	3	5	4	4	3
9	4	4	2	4	3	3	3
10	3	2	1	3	1	2	2
11	2	1	1	2	1	1	2
12	1	1	1	1	1	1	1

From above table we can calculate the following:

$$U/_{Ind(C)} = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6\},\{7\},\{8\},\{9\},\{10\},\{11\},\{12\}\}$$
$$U/_{Ind(C-\{C_1\})} = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6\},\{7,11\},\{8\},\{9\},\{10\},\{12\}\}$$
$$U/_{Ind(C-\{C_2\})} = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6\},\{7\},\{8\},\{9\},\{10\},\{11\},\{12\}\}$$
$$U/_{Ind(C-\{C_3\})} = \{\{1\},\{2,3\},\{4\},\{5\},\{6\},\{7\},\{8\},\{9\},\{10\},\{11\},\{12\}\}$$
$$U/_{Ind(C-\{C_4\})} = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6,7,11\},\{8\},\{9\},\{10\},\{12\}\}$$
$$U/_{Ind(C-\{C_5\})} = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6\},\{7\},\{8\},\{9\},\{10\},\{11\},\{12\}\}$$
$$U/_{Ind(C-\{C_6\})} = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6\},\{7\},\{8\},\{9\},\{10\},\{11\},\{12\}\}$$
$$U/_{Ind(C-\{C_7\})} = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6,12\},\{7\},\{8\},\{9\},\{10\},\{11\}\}$$

$$POS(C) = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6\},\{7\},\{8\},\{9\},\{10\},\{11\},\{12\}\} = 12$$
$$POS_{C-\{C_1\}}(C) = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6\},\{8\},\{9\},\{10\},\{12\}\} = 10$$
$$POS_{C-\{C_2\}}(C) = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6\},\{7\},\{8\},\{9\},\{10\},\{11\},\{12\}\} = 12$$
$$POS_{C-\{C_3\}}(C) = \{\{1\},\{4\},\{5\},\{6\},\{7\},\{8\},\{9\},\{10\},\{11\},\{12\}\} = 10$$
$$POS_{C-\{C_4\}}(C) = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{8\},\{9\},\{10\},\{12\}\} = 9$$
$$POS_{C-\{C_5\}}(C) = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6\},\{7\},\{8\},\{9\},\{10\},\{11\},\{12\}\} = 12$$
$$POS_{C-\{C_6\}}(C) = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{6\},\{7\},\{8\},\{9\},\{10\},\{11\},\{12\}\} = 12$$
$$POS_{C-\{C_7\}}(C) = \{\{1\},\{2\},\{3\},\{4\},\{5\},\{7\},\{8\},\{9\},\{10\},\{11\}\} = 10$$

Therefore, the importance of each index is:

$$S_A(C_1) == \frac{|POS_A(A)| - |POS_{A-\{C_1\}}(A)|}{|U|} = \frac{12-10}{12} = \frac{2}{12} = 0.1667$$

$$S_A(C_2) == \frac{|POS_A(A)| - |POS_{A-\{C_2\}}(A)|}{|U|} = \frac{12-12}{12} = \frac{0}{12} = 0$$

$$S_A(C_3) == \frac{|POS_A(A)| - |POS_{A-\{C_3\}}(A)|}{|U|} = \frac{12-10}{12} = \frac{2}{12} = 0.1667$$

$$S_A(C_4) == \frac{|POS_A(A)| - |POS_{A-\{C_4\}}(A)|}{|U|} = \frac{12-9}{12} = \frac{3}{12} = 0.25$$

$$S_A(C_5) == \frac{|POS_A(A)| - |POS_{A-\{C_5\}}(A)|}{|U|} = \frac{12-12}{12} = \frac{0}{12} = 0$$

$$S_A(C_6) == \frac{|POS_A(A)| - |POS_{A-\{C_6\}}(A)|}{|U|} = \frac{12-12}{12} = \frac{0}{12} = 0$$

$$S_A(C_7) == \frac{|POS_A(A)| - |POS_{A-\{C_7\}}(A)|}{|U|} = \frac{12-10}{12} = \frac{2}{12} = 0.1667$$

The weight of index C_1 is :

$$W_1 = \frac{S_A(C_1)}{\sum_{i=1}^{m} S_A(C_1)} = \frac{0.1667}{0.1667+0+0.1667+0.25+0+0+0.1667} = 0.222$$

Similarly, one can also calculate the weights of other indexes and given in table 3.

Table 3: Weight index value of the attributes

Index (C_i)	C_1	C_2	C_3	C_4	C_5	C_6	C_7
Weights(W_i)	0.2222	0	0.22223	0.5713	0	0	0.2222

The comprehensive assessment value of each object can be calculated by using the formula $P_j = \sum_{i=1}^{m} w_i f_i$

$P_1 = w_1.f_1 + w_2.f_2 + w_3.f_3 + w_4.f_4 + w_5.f_5 + w_6.f_6$
$= 0.2222 \times 5 + 0 \times 5 + 0.22223 \times 5 + 0.5713 \times 5 + 0 \times 4 + 0 \times 5 + 0.2222 \times 3$
$= 1.111 + 0 + 1.1115 + 2.8565 + 0 + 0 + 0.6666$
$= 5.7456$

Similarly, the comprehensive assessment values of other objects can also be calculated and tabulated in Table 4.

Table 4: Assessment value for the object

Institutions	The Assessment Value
1	5.7456
2	1.3173
3	1.8837
4	1.3529
5	1.6925
6	0.6695
7	0.7540
8	1.411
9	1.255
10	0.9371
11	0.7822
12	1.2376

IV. RESULTS AND DISCUSSIONS

From table no.4, it can be concluded that institution 1 is the highest in institutional assessment with the comprehensive assessment value of 5.7456 and one can understand that the institution is concentrating more on NAAC assessment criterion. Institution 3 has the assessment value of 1.8837 and we can comprehend that the institution has to progress several aspects such as Teaching learning process, research and development etc. The management may give appropriate guidelines for

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improvement of the institution to the employees. The institution 6 has the least value and is worst. The head of the institution must concentrate how to involve the employees to contribute continuously and increase academic performance levels in the entire NAAC/NBA criterion to make more efforts for obtaining accreditation. Those institutions, which do not advance their levels, may not run for consequent years. The institutions with least assessment value means that the institutions do not care about their Curricular Aspects , Teaching Learning and Evaluation, Research Consultancy and Extension , Infrastructure and Learning Resources, Student Support and Progression, Governance and Leadership, and Innovative Practices. The head of the institution and the management must find out the reasons to overcome and also push them back to work hard to maintain the standards of the institution.

V. CONCLUSION

This paper deals higher educational institutional assessment, which identifies the weights of every index in the assessment indexes system of institution by the attributes of importance degree by using rough set theory. Experimental analysis shows that this model produces better prediction on several datasets, and achieves excellent performance. If any institution wants to improve their ranking institution must have clear vision, mission, leadership, commitment and coordination of faculty members.

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