Soft Set Approaches for Choosing Good Academic Institution for Higher Studies

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Abstract:- **Academic is the knowledge centre of human beings, which provides platform for gaining knowledge in the specialized area of study, creating opportunities for recruitment, self sufficient, managing family, contributing in the development of the society as well as economic growth of the country. Due to above reasons every parent's want their children should study in a good environment and groomed their children well as per expectation. The procedure of selecting good institutes is a difficult task with the web based technology and internet because the colorful presentation & pictorial clipping attract everyone even though the institute is not like that. It is also cumbersome to search institute by visit one by one which not only time consuming but also expensive one. In such situation people having the option to believe on the advertisement, websites and what their knowledge speaks about the institute. The ranking institute which are coming in the leading papers, magazines and electronic medias and other sources prepared by various agencies are sometimes not affordable to the parents due to distance, monetary factors and unable to get a position in the state and national level competitions. There is also not any specific formula for analysis of good institute. The research paper used to find a solution to above problems by using weighted fuzzy soft set and dual weighted analysis with the help of different parameters related to academic institutes in an efficient manner and short time.**

Keywords: Knowledge Centre, Web based Technology, Fuzzy Soft Set, Dual Weighted Analysis.

I. INTRODUCTION

Institutes offering various technical and professional courses of affiliated universities and also focusing on student enrolment, education, skill based training and their placement in national and multinational organizations. Due to mushrooming growth of organizations and competitions among them forced to compromise in different aspects of academic. The differences comes among institutions in the form of faculties, good infrastructure, results, continuous evaluation for better development, new ideas for research, initial training for placement, library support, hostel facilities etc. In such situation, any decision regarding good programs of an institute or good institutes for taking admission is going to be a difficult task for both parents as well as aspirants. Even if, candidates having good ranking in the state and national level competitions are also being confused regarding selection of technical or professional institutions for higher studies After all most of the institutes are lacking to improve the communication skills of the students which is the key criteria for recruiters to select the candidates either in the campus drive or off-campus organized by different institutes. In the present scenario arranging classes on moral values and discussing on educational impact to the society are completely missing which force the students to divert themselves from their objectives and involving them in different unsocial activities. Sometimes government agencies are also supporting such institutes either in pressure of promoting technical or professional studies or insufficient manpower to evaluate such institutes. All these issues forcing aspirants to deviate from their earlier decisions of joining institute in interest programs for higher study or allowing them to choose institutes of other states which have good reputation but less knowledge about the actual functioning.

In such context of decision making, a strong mathematical/computational logic will play a significant role to select the best one from the availabilities. Particularly the values of institutional and educational parameters help decision makers to take right decision at right time. As we know selection process involves series of activities basing on different criteria to draw final conclusion but all steps must be refined because it define shape of students and their contribution to the family & society. The above analysis disallows a candidate from preplanned decision and compels to know about other parameter which makes them to choose a good institute for study. Any minor differences in values of parameters may create vagueness and uncertainty but does not create big problem in choosing the institute. The classical mathematics might not be an ideal decision in dealing with such problems.

There are many theories are available using their expanded tools set for decision making in probability, fuzzy set, rough etc. have tried to resolve the problems. But all these techniques do not consider parameterization tools; therefore the above concepts are unable to solve the problems of uncertainties. The soft set concept overcome all these problems and having rich potential of solving certain decision making problems like selection of good academic institutions

for higher studies, customers preference for product selection, man power recruitment problem etc.

Most of the parents and student aspirants find difficulties in selecting good institutions which based on certain key and common parameters. And again all institutions may not satisfy all the parameters and in some cases aspirants having their own expectation and choice for selection of good institutions.

This paper elaborating new techniques using fuzzy soft set and applied in solving decision making problems. Particularly techniques are applied for choosing good institutions for higher studies by considering few important parameters and this process not only comfortable but also needed low cost and time.

II. RELIMINARIES

Molodtsov was proposed soft set theory which is a generalization of fuzzy set deal with uncertainty in a non-parametric manner. As we know soft set is a parameterized family of sets and it is "soft" because the boundary of the set depends on the parameters. A soft set over a universal set U and set of parameters P is a pair (f, S) where S is a subset of P, and f is a function from S to the power set of U. For each e in S, the set f(e) is called the value set of e in (f, S).

The useful definition from Maji et al. (2002;2003) and basic notion of all soft theory are discussed here, where U to be an initial universal set and P to be a set of parameters of S,T $\subset$ P.

Theorem 2.1 (Soft Set)

A pair of (P,f) is called a soft set over if and only if Q is a mapping of P into the set of all subsets of the set U. In order words, the soft set is a parameterized family of subsets of the set U. Every set Q(e), e ϵ P, from this family may be considered as the set of e-approximate elements of the soft set. Let us consider the following example.

Example 2.1: A soft set (Q,e) describes the features of a freeze which Mr. A is going to buy [Pal & Mondal, 2011].

U is the set of bikes under consideration. P is the set of parameters. Each parameter is a word or a sentence.

P=(p1=colour; p2=carrying capacity; p3=consumption of electricity, p4=cooling facility; p5=cost; p6=compressor guarantee; p7=services; p8=additional benefits; p9=door option; p10=stabilizer free).

In the above example soft set defines attractive, compressor option, cost and consumption of electricity etc.

Theorem 2.2 (Operation with Soft Sets)

Suppose a binary operation denoted by *, is defined for all subsets of the set U. Let (Q, S) and (R, T) be two soft sets over U. Then the operation * for the soft sets is defined in the following way: (Q, S) * (R, T) = (R1, S x T), where R1 (α, β) = Q (α) * R (β), $\alpha \epsilon$ S, $\beta \epsilon$ T and S x T is the Cartesian product of the sets S and T.

Theorem 2.3 (NOT Set of a Set of Parameters)

Let P= {p1, p2, p3……p_n} be a set of parameters. The Not set of P denoted by ⅂P and is defined by ⅂P ={p1,p2,p3…..pn}, where ⅂p_i =not p_i for all i. It may be noted that ⅂ and ⅂ are two different operations.

Theorem 2.4 (Complement of a Soft Set)

The complement of a soft set (Q, S) is denoted by $(Q, S)^c$ and is defined by $(Q, S)^c = (Q^c, ⅂S)$, where Q^c: ⅂S→P1(U) is a mapping which is defined by $Q^c(\alpha) = U-Q(⅂\alpha)$, for all $\alpha \epsilon$S.

Theorem 2.5 (Relative Complement of a Soft Set)

The relative complement of a soft set (Q, S) denoted by $(Q, S)^r$ and is defined by $(Q,s)^r=(Q^r,S)$, where Q^r:S→P1(U) is a mapping given by $Q^r(\alpha)=U-Q(\alpha)$, for all $\alpha \epsilon$S.

Theorem 2.6 (OR Operation on Two Soft Sets)

If (F, A) and (G, B) be two soft set then (F, A) OR (G, B) denoted by (F, A) $\vee$ (G, B) and is defined by (F, A)(G, B)=(O, A x B), where $O(\alpha, \beta) = F(\alpha) \cap G(\beta)$ for all $(\alpha, \beta) \epsilon$ A x B.

Theorem 2.7 (AND Operation on Two Soft Sets)

If (Q, S) and (R, T) be two soft set then (Q, S) AND (G, B) denoted by (F, A) $\wedge$ (G, B) and is defined by (F, A)(G, B)=(H, A x B), where $H(\alpha, \beta) = F(\alpha) \cap G(\beta)$ for all $(\alpha, \beta) \epsilon$ A x B.

Theorem 2.8 (Absolute Soft Set)

The relative whole soft set U(P) with respect to the universe parameters P is called the absolute soft set over U.

Theorem 2.9 (NULL Soft Set)

A soft set (Q, S) over U is said to be a NULL soft set (denoted by ϕ), if for all $\varepsilon \epsilon$S, $Q(\varepsilon)=\phi$ (null set).

Theorem 2.10 (Relative NULL Soft Set)

A soft set (Q, S) over U is said to be a NULL soft set with respect to parameters set S denoted by ϕ S, if $\varepsilon \epsilon$ S, $Q(\varepsilon)=\phi$ (null set).

Theorem 2.11 (Relative Whole Soft Set)

A soft set (Q, S) over U is said to be a relative whole soft set with respect to parameters set S denoted by U, if for all $\varepsilon \epsilon$ S, $Q(\varepsilon)=U$.

III. LITERATURE REVIEW OF SOFT SET THEORY

Fuzzy set theory, which become a very important tool to solve problems and provides an appropriate framework for representing unclear concepts by allowing partial membership. This concept was proposed by Zadeh in the year 1965. It is studied by both mathematicians and computer scientists and used in many applications of fuzzy set theory over the years, such as fuzzy control systems, fuzzy automata, fuzzy logic, fuzzy topology etc. There are also theories like probability, rough set theory etc. used with fuzzy set to overcome the vagueness in decision making problems. Molodtsov, who was introduced the concept of soft set theory which is completely new approach for modeling uncertainty and tries to remove inherent difficulties lies in the existing theories.

A combination of fuzzy and soft set theories, fuzzy soft set theory is a more general soft set model which makes descriptions of the objective world more general, realistic, practical and accurate in some cases of decision making was presented by Maji et al., (2001). It is again presented in 2003 with some implementation in their work. A novel method presented by Roy & Maji (2007) for object recognition from an imprecise multi observer data in decision making problem. The relationship between soft sets and information systems have discussed by Pei & Miao (2005 which showed that soft sets are a class of special information systems. After soft sets are extended to several classes of general cases, the more general results also show that partition type soft sets and information systems have the same formal structures, and that fuzzy soft set and fuzzy information systems are equivalent. Xiao et al., (2005) in his paper, an appropriate definition and method is establishing the information table based on soft sets theory and at the same time the solutions are proposed corresponding to the different recognition vectors.

The texture classification via Soft Set Theory based in a classification Algorithm was studied by Mushrif et al., (2006). Aktas & Cagman (2007) have introduces the basis properties of soft sets and compare soft sets to the related concepts of fuzzy sets and rough sets. Kovkov et al., (2007), have presented the stability of sets given by constraints is considered within the context of the theory of soft sets.

The concept of soft fuzzy set and its properties was presented by Yao et al., (2008). Xiao et al., (2008) in his paper, data analysis approaches of soft sets under incomplete information is calculated by weighted average of all possible choice values of the object and the weight of each possible choice value is decided by the distribution of other objects. Ali et al.,(2009) gives some new notion such as the restricted intersection, the restricted union, the restricted difference and the extended intersection of two soft sets.

To visualize the soft maximal association rules which contain discovering, visualizing maximal supported sets, capturing and finally visualizing the maximal rules under soft set theory proposed by Herawan etal. (2009).

IV. ANALYSIS

4.1. About the Institution

Every graduate is in pursuit of a better career and a secured job. There is a heavy competition in the corporate job market. Everyone wants to sharpen their technical skills or update them to secure the best job. The rise of unemployment and under employment has led to the necessity of exclusive training institutes that can provide adequate training to students in several fields. The role of Institute is vital. But there are numerous training institutes mushrooming everywhere and for that we need to make optimal choice while selecting the institute. There are following parameters which need to consider while joining any training institute.

- Evaluate your own personal skills and talents before you decide to join an institute.
- Evaluate the current market trend and know the latest demand for professional skills and related job openings.
- It is important to choose institutes that provide authentic certifications that increase the possibilities and probabilities of good job opportunity.
- Find out if they have a good track record of providing good training and should verify any sign of inconsistency.
- Discuss with the students those who had already completed their training in any of the institutes that we looking for.
- Check and compare the syllabus of all institutes.
- Enquire about the fees structure of the institute and that to count in terms of value for money and provide easy payment options.
- Verify the faculty details of the Institutes because they are the soul of institute.
- Make sure whether the institute provides end to end care for the candidates.
- Ask the institute regarding the past statistics of the pass and growth percentage.
- Ask about the placement records of the institute.

Characteristics of Institutions

The characteristics of different institutions may be similar; the value that is placed on the institution is mostly determined by the society or community in which it is used. The Institutions of one community may be acceptable in providing a valued outcome, but be unacceptable in another community because the outcomes may be seen to disadvantage the members.

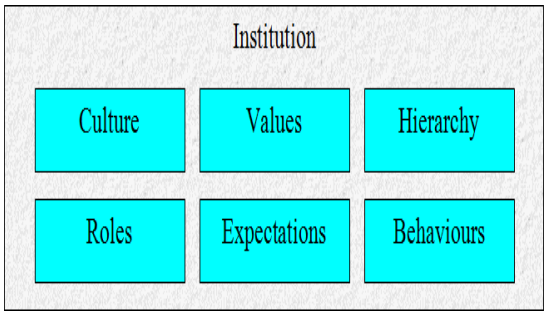

Figure 4.1 Characteristics of an Institution

Culture: The set of shared attitudes, values, goals, and practices that characterizes an institution. The culture of the institution is the way the institution is organized and it is generally determined by its role in society.

Values: Institutional values are different to our personal values in that they allow the individuals to function within the institution.

Hierarchy: Institutions are all about a means of coordination and cooperation. The hierarchy defines the agenda and purpose, and the way things get done.

Roles: Leadership is probably the most important role, and provides the identity and purpose within the institution. Other roles are determined by the hierarchy and the members in fulfilling the agenda and purpose of the institution.

Expectations: The members are expected to fulfill their assigned role within the institution.

Behaviours: The way the members treat each other or interact with each other is determined by the culture, values, hierarchy, roles and expectations of the members within the institution.

4.2. Institution Data set for selection and its approaches

The following are the key parameters are to be analyzed before taking admission elsewhere. Excluding the above there are certain parameters which are changed time to time as per performance of the institution and also play important roles for final decision making.

The key parameters are NAC Accreditation, NBA Accreditation, Latest Affiliation, Years of Running (More than 5years considered as 1 point else 0), Location (Urban-1/Rural-0), Old Students Remark (Positive-1/Negative or no-response-0) and overall remarks (placement, teaching, distance etc.(Positive-1, Negative/Not-available-0).

The parameter which are varies from time to time is called changeable parameters. These are as follows.

Infrastructure, Laboratory, Workshop, Placement, Faculties, Teaching Aid, Transportation Facilities, Administration, Hostel, Common Room, Levorotary, Library, Internet Access, Seminars, Security, Skill based Training, Alumni Association, welfare activities etc.

Therefore the analysis is divided into two segments. The first segment will focus on key parameters which are enough to take the decision. The values of the parameters are placed in the form of 1 or 0 to calculate the weight and then arranged in ascending order and then the highest weight among the list to be chosen for selection. This is called weighted method and it is suitable when few parameters are to be considered for decision making. Whenever the parameters are large in numbers then the approach itself is complex to draw the conclusion.

If we are confused with the existing decision then we will focus on both the key and changed parameters. The key parameters and its weight are placed in the first table. The changeable or situational parameters of different institutions are calculated using fuzzy soft set values i.e. 0 and 1 and then different weightage are assigned for different parameters as like first table and create the second table. Finally net weight (key weighted value + changeable value) of each institution is calculated. Out of the weights, the maximum, value is considered for seeking admission in an institution. The first table given the satisfaction and the other factors of an institute is chosen from the second table which adds more accuracy to the decision making process. Though there are two tables used collectively for decision making, the analysis is popularly called as Dual Weighted Analysis.

4.3. Weighted Table of a Soft Set

A new theory of mathematical analysis called as "theory of weighted-softset" used to know about the concept whether a membership function be regarded as the only characteristic function of a fuzzy set. The concept was presented by Lin[35]. In the reduct-soft have entries $d_{ij}=w_j \times p_{ij}$, instead of 0 and 1, where p_{ij} are the entries in the table of the reduct- soft set.

The weighted choice value of an object (institution) is calculated given by

$$c_i=\sum_j d_{ij}$$

where $d_{ij} = w_j \times p_{ij}$.

Weighted Algorithm for Selection of Institutions

The following algorithm is used for decision making to select of an Institution for higher studies which are basing on key parameters.

- Input the soft set (P, Q).
- Input the set of choice parameters which are applicable for selection.

- Find all reduct soft sets.
- Use applied weight for selected parameters..
- Find k, for which p_k=max p_i.'

Then p_k is the optimal choice object. If k has more than one value, then any one of them could be chosen by using the options.

Example: If any parents (Let Mr. X) used weighted algorithm and defining various weights for parameters then the solution for selection institution can be drawn in following manner.

Suppose that Mr. X sets the following weights for the parameter i.e. NAC Accreditation (w1=1), NBA Accreditation (w2=0.5), Latest Affiliation (w3=1), Years of Running (w4=.75), Location (w5=0.25), Old Students Remark (w6=0.75) and overall remarks (w7=0.8) .

The table shows different weights for different institutions. Mr. X has options to select the best institution by choosing highest weight from the table because all the parameters used in the table are keys to the success of joining good institution for higher study. Here Mr. X will select the college c5 for joining in higher studies.

U	p_1 w1=1	p_2 w2=0.5	p_3 w3=1	p_4 w4=0.75	p_5 w5=0.25	p_6 w6=0.75	p_7 w7=0.8	Choice Value
C_1	1	0	1	1	0	1	1	C1=4.3
C_2	0	1	1	1	1	1	0	C2=3.25
C_3	0	0	1	0	0	1	1	C3=2.55
C_4	0	0	1	0	0	0	0	C4=1
C_5	1	1	1	1	0	1	1	C5=4.8
C_6	0	0	0	1	0	1	1	C6=2.3
C_7	0	0	1	1	0	1	0	C7=2.5
C_8	1	1	1	0	1	1	1	C8=4.3

Table 4.3 Weighted Table Key Parameters

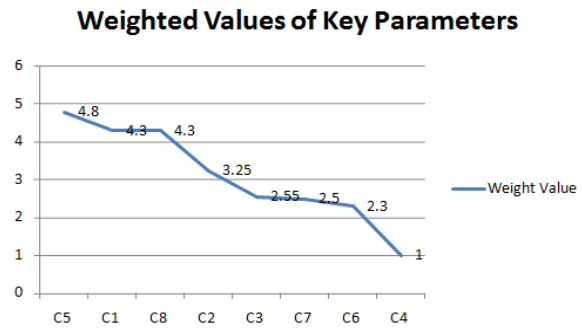

Figure 4.2 Graphical Presentation of weighted values of Key Parameters

But in the above method is suitable if no. of key parameters is less to take the final decision. Whenever the parameters are more, this method might not be enough to take the decision. In such situation dual weighted analysis is the best choice for accurate decision in less time.

4.4. Dual Weighted Analysis for Selection of Institutions

In this method the previous weighted table (Table – 4.3) is to be arranged in descending order because it carries all the key parameters and their weights.

The additional parameters which are left in the first table are to be used in the second table and calculate their grand weight as per weight assigned by the user. When the method used for reference, the first table is to be referred as per weight and then the second table also to be referred as per highest weight. Finally decision will be taken because in most of the cases the sequence in the first table is same as in the second table. But in some cases the sequence of weight in second table is varied due to better performance of changeable or situational parameters. In such cases the combine weight of both the table is chosen for final decision.

For example Mr. X is not satisfied with the existing decision and wants to use other changeable parameters for decision making. In such situation the result can be obtained by adding both the calculated weight given in the tables as per institution and then the best one to be chosen for admission.

The weight of changeable parameters can be obtained or assigned by getting accurate data from the institution as it is internal to the institution; otherwise it may not provide accuracy for decision making. As per collected data, the weightage given to the following parameters as follows.

1. If fully Infrastructure available then yes= 1, otherwise 0. (Weightage=1)
2 If Laboratory is available then yes=1, otherwise 0. (Weightage=1)
3. If Workshop is available then yes=1, otherwise 0. (Weightage=1)
4. If Placement is given then yes=1, otherwise 0. (Weightage=1)
5. If required Faculties are available then yes=1, otherwise 0. (Weightage=1)
6. If Transportation Facilities given to the students then yes=1, otherwise 0. (Weightage=1)
7. If Hostel facilities is available then yes=1, otherwise 0. (Weightage=1)

The weighted values of these parameters are given as 1 because all are genuine and data collected through direct visit to the institution. In some cases the value may be less than one if the individual details are more accurately available for analysis.

If any other parameters are available then it must be included in the list to calculate the weight.

U	p_1 w1=1	p_2 w2=0.5	p_3 w3=1	p_4 w4=0.75	p_5 w5=0.25	p_6 w6=0.75	p_7 w7=0.8	Weight Value
C_5	1	1	1	1	0	1	1	4.8
C_1	1	0	1	1	0	1	1	4.3
C_8	1	1	1	0	1	1	1	4.3
C_2	0	1	1	1	1	1	0	3.25
C_3	0	0	1	0	0	1	1	2.55
C_7	0	0	1	1	0	1	0	2.5
C_6	0	0	0	1	0	1	1	2.3
C_4	0	0	1	0	0	0	0	1

Table 4.3 Sorted Weighted Sequence of Key Parameters Table

U	cp_1 w1=1	cp_2 w2=1	cp_3 w3=1	cp_4 w4=1	cp_5 w5=1	cp_6 w 6=1	cp_7 w7=1	Weight Value
C_5	1	1	1	1	1	1	1	7
C_1	1	1	1	0	1	1	1	6
C_8	1	1	1	0	1	1	1	6
C_2	0	1	1	1	1	1	1	6
C_3	1	1	1	0	1	0	1	5
C_7	0	1	1	1	1	1	0	5
C_6	0	1	1	0	1	1	0	4
C_4	1	1	1	0	1	0	0	4

Table 4.4 Sorted Weighted Sequence of Changeable Parameters Table

When Mr. X used the changeable parameter table (Table 4.4) and found that the institution C_5 again lies at the top of the sorted changeable parameter table. In such case Mr. X has the option to choose C_5 as the best institution for higher studies as compare to other institution. If Mr. X deviates from the first decision then the institution lies second in the list to be chosen for selection as a good institution.

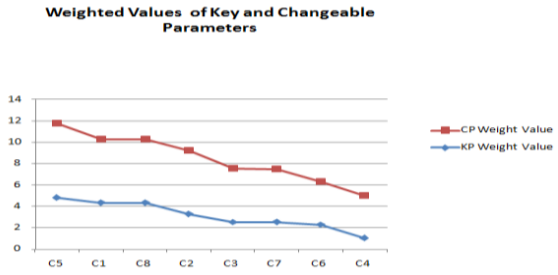

Figure 4.3 Graphical Presentation of weighted values of Changeable Parameters

In some cases the weighted value sequence of an institution in the changeable parameter table is better as compared to the key parameters table. In such situation the best understanding is to add the weights of both the table for an institution to know the best possible result.

V. CONCLUSION

The research creates a better impact on the society and allows the users to choose a good institution for higher studies in short time without visiting the institutions but visit bringing more accuracy to the decision. It differentiates different parameters into groups as per highest priority for decision making. The accuracy in the parameters is always played a key role for actual selection. The research allows the decision makers either to take decisions only by using key parameters which reduces the time and cost of decision or by both the key as well as changeable parameters for more accuracy. Sometimes difficulties arises when the sorted sequence is altered due to better performance of changeable parameters but it can be easily solved by adding the weights of both the tables in respect of institutions and then select the best as per weight. The study can be further enhanced by implementing existing or new soft set soft set techniques to the existing work for better and faster result.

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