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Fuzzy Expert Model for Evaluation of Faculty Performance in Technical Educational Institutions

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ABSTRACT

In developing countries, higher education is seen as an essential means for creation and development of resources and for improving the life of people to whom it has to serve. Worldwide National policies on higher education are been given increasing importance to improve the quality of education on offer. Consequently, the evaluation of Faculty performance in teaching activity is especially relevant for the academic institutions. It helps to define efficient plans to guarantee quality of teachers and the teaching learning process. In this paper, an optimization Evolution model for academic performance of the faculty's in technical institutions based on teaching activity series of qualitative reports is presented. We have proposed a Fuzzy Expert System for evaluating teachers overall performance based on fuzzy logic techniques under uncertain facts in the decision making process. A suitable fuzzy inference mechanism and associated rules are been discussed. It introduces the principles behind fuzzy logic and illustrates how these principles could be applied by educators to evaluating faculty's performance. This model will help to write the Annual Confidential Reports of all the employees of an organization.

Keywords **-** Fuzzy logic, R&D, Faculty, Member Function.

I. INTRODUCTION

In developing countries, like India and other countries, higher education is seen as an essential means for creation and development of resources and for improving the life of people to whom it has to serve. A highly reliable and effective performance evaluation rule is essential in decision making environments. There is increased consensus that highly qualified, quality, and effective teachers and teaching is necessary to improve the academic performance of the students and there is growing an interest in identifying individual teacher's impact on student's achievement and also improvement of image of the educational institutes. Federal definitions suggest every faculty to assess themselves regularly to meet this requirement. Though students gain on standardized achievements is one important aspect of teaching ability, it is not only the comprehensive and robust view of teacher effectiveness.

In this paper we propose an optimization model and an interactive online Faculty Performance Appraisal System provides faculty's with meaningful appraisals that encourage professional learning and growth. The process is designed to foster teacher development and identify opportunities for additional support where required [6].To assess the performance of individual faculty in the institutions by integrating planning and review in the areas viz., Feedback from students, Teachers self appraisal, Assessment by peers, and Results of University exams by providing a structure Online Interactive Interface that possesses potential related assessment data of Faculty in educational institutions. By helping teachers achieve their full potential, the performance appraisal process represents one element of achieving high levels of student performance.

Conventional evaluation systems are representatives of structured systems that employ quantifiable and non quantifiable measures of evaluation. It is often difficult to quantify performance dimensions. For example, "teaching" may be an important part of the appraisal. However, how exactly does one measure "teaching". Academic administrators often face such issues when trying to evaluate a staff's performance.

And also staff has to spend a lot of time in evaluating each faculty performance manually. This is not only a

time consuming process but may sometimes lead to errors in calculations. These two problems may increase the number of persons who involve in the process. Fuzzy approach can be effectively utilized to handle imprecision and uncertainty [7]. This approach to performance appraisal allows the organization to exercise professional judgment in evaluating its employees. In real problems, evaluation techniques engage in handling cases like subjectivity, fuzziness and imprecise information. Application of the fuzzy set theory in evaluation systems can improve evaluation results [1]. Several researchers have tried to solve this problem through the analytical hierarchy process (AHP) [2], for example in personnel selection [3] and shipping performance evaluation [4], whereby evaluation is done by aggregating all the fuzzy sets.

This paper has seven sections. The next section gives a survey of Fuzzy Logic System in evolution of faculty performance. Section 3 describes the optimal Architectural Model for Faculty Performance Assessment. Section 4 describes the Proposed Method for Faculty Performance Evaluation. Section 5 describes the Fuzzy Expert System for Faculty Performance Evaluation. Section 6 describes the experimental result of proposed rule based Fuzzy Expert System. We conclude paper with Section 7.

II. SURVEY OF FUZZY METHODS IN ASSESSMENT OF FACULTY PERFORMANCE

While fuzzy logic techniques have earned their place in a variety of field ranging from engineering to financial sector, to medicine, few efforts have been made to test the potential usefulness of these methods in the modeling academic performance evaluation. This section discusses the literature survey about the past and current research application of fuzzy logic. It discusses about the academic achievement of student and teacher, prediction model and academic performance evaluation fuzzy logic approaches in academic performance evaluation.

(A) Modeling Academic Performance Evaluation Using Soft Computing Techniques: A Fuzzy Logic Approach.

Ramjeet Singh Yadav et al., (2011) [9], proposed a Fuzzy Expert System (FES) for student academic performance evaluation using fuzzy logic techniques. A suitable fuzzy inference mechanism and associated rule has been discussed. It introduces the principles behind fuzzy logic and illustrates how these principles could be applied by educators to evaluate student academic performance. Several approaches using fuzzy logic techniques have been proposed to provide a practical method for evaluating student academic performance and comparing the results (performance) with existing statistical method.

(B) Evaluation of Teacher's Performance Evaluation Using Fuzzy Logic Techniques.

Sirigiri Pavani et al., (2012) [8], proposed a method to deal with the evaluation of teacher's academic performance evaluation using fuzzy logic techniques of Fuzzification of Semester Examination Results and Performance Value.

(C) Soft Computing Model for Academic Performance of Teachers Using Fuzzy Logic

O.K. Chaudhari et al., (2012) [10] proposed a Fuzzy Expert System for evaluating teachers overall performance based on fuzzy logic techniques under "uncertain facts" in the decision making process. A suitable fuzzy inference mechanism and associated rule has been discussed. It introduces the principles behind fuzzy logic and illustrates how these principles could be applied by educators to evaluate teachers' performance. This model will help to write the Annual Confidential Reports of all the employees of an organization.

(D) An Evaluation of Students Performance in Oral Presentation Using Fuzzy Approach

Wan Suhan Wan Daud et al., (2011) [11], proposed a method for evaluating student's academic performance using fuzzy logic approach. They pointed that the evaluation of students' performance is a process of making judgment on a student based on several elements such as examinations, assignment, test, quiz, research work and so on. They have used the following methodology for evaluating students' performance.

(E) Fuzzy Logic Based Evaluation of Performance of Students in Colleges

Mamatha S. Upadhya (2012) [12], proposed a method for evaluation of students' performance based on fuzzy logic. This system is dealt with the range of possible values for the input and output variables determined. These (in language of fuzzy set theory) are the membership function (input variables vs. the degree of membership function) used to map the real world measurement values to the fuzzy values. Values of the input variables are considered in term of percentage.

III. ARCHITECTURAL MODAL FOR FACULTY PERFORMANCE ASSESSMENT

The evaluation of teaching activity can be defined as the systematic evaluation of teaching performance according to the professional role and contribution required to reach the objectives of the course taking into consideration the institutional context [13]. Therefore, teaching activity implies the planning and management of teaching, the

deployment of teaching methods, learning and evaluation activities, and finally the revision and improvement of the procedures carried out. A multi-criteria analysis in ranking the quality of teaching using fuzzy rule was proposed in [14].

To put the existing teachers on track, it is very necessary to evaluate their performance, may be in quarterly, in semester or annually, depending upon the resources in academic institutes. University or the institutions of higher education do not have uniform standard method or computerized solution for evaluating teachers' performance that covers all factors affecting directly or indirectly the quality of university or the institutes. Hence the fuzzy logic model is introduced to evaluate the teachers overall performance through his or her involvement in the various sub activity involved in the institute. The proposed Optimized architectural model of Faculty's Assessment system in Fig.1.

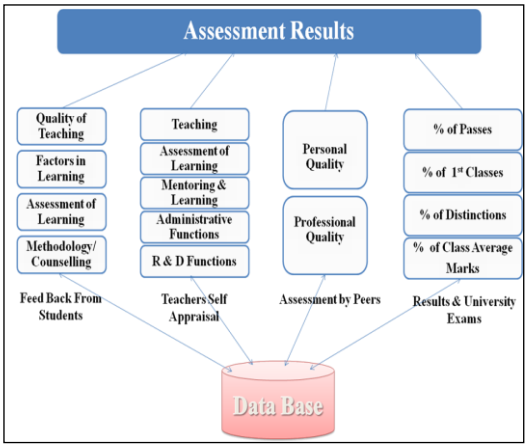


Fig.1 Architectural Modal for Faculty Performance Assessment

Feed Back from Students: Keeping a record of faculty activities and insights from seeking feedback on faculty teaching and units is an essential aid to your reflection, particularly over time as memory inevitably dims. Such records help you in going through the cycle of clarifying your teaching goals, identifying strengths and weaknesses in achieving these goals, narrowing down any areas for improvement, devising courses of action for improvement, and reflecting on these changes as they are put into practice.

Teacher Self Appraisal: Teacher self appraisal is a mechanism for improving teaching and learning. We all agree that teachers' professional competence and conscientiousness are the keys to the delivery of quality education in educational institutions. In a well-designed staff appraisal system, the instruments and procedures can constitute valuable professional development for teachers and enable the college management to assess teachers' performance. The teacher appraisal system assists in recognizing and encouraging good performance, identifying areas for development, and improving overall performance of teachers.

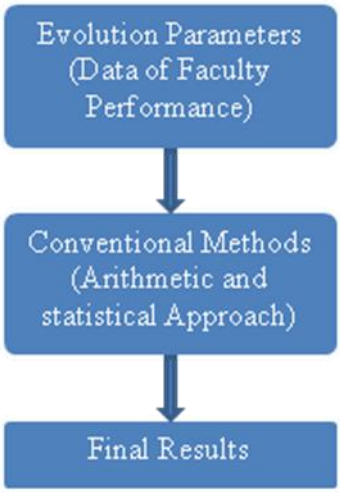
Assessment by Peers: Peer review of academic practice is commonplace in educational institutes. It is a well accepted source of information for development and assessment in the realms of personal quality and professional quality. Unfortunately, there is a tendency to think that peer review of teaching works in the same way as peer review of personal quality and professional quality. It is this misapprehension of peer review in teaching that associates it so strongly with the assessment of teaching. There is an assessment function for peer review in teaching, of course, with Heads of departments being a major source of information for tenure and promotion at the institutions and elsewhere. Its greater virtue however is in the development of teaching. Peer review involves informed and formative exchanges between colleagues on every aspect of what they do to help learning to occur. Peer reviewers work together to improve the way they work individually with and for students. Under ideal conditions they do this collaboratively over a period of time.

Results and University Exams: Writing effective and efficient exams is a crucial component of the teaching and learning process. Exams are a common approach to assess student learning and the results are useful in a variety of ways. Most often, results are used to provide students feedback on what they learned or evaluate the instructional effectiveness of a course.

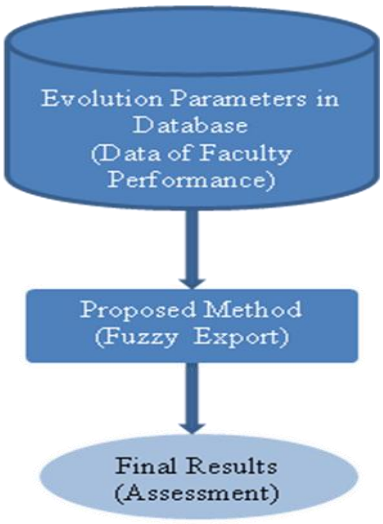
IV. PROPOSED METHOD FOR FACULTY PERFORMANCE EVALUATION

One of the drawbacks of the conventional faculty evaluation methods in Fig.2 (a), is the lack of information behind the evaluation methods that have been used and what criteria for the 'final result'. To do so, a fuzzy approach has been used to perform the proposed method of faculty performance evaluation. It is important to point out that the aim of the proposed method is not to replace the current traditional method of evaluation, instead it will strengthen the present system by providing additional information to be used for decision making by the user through online system.Fig.2(b) shows the proposed method fuzzy Expert System of faculty performance evaluation. This system for storage of data has been planned to use the Oracle Database and all the user interfaces has been designed using the JSP technologies. It takes care of different modules

and their associated functionalities and reports which are produced as per the applicable strategies.



(a) Process of Traditional Evolution



(b) Proposed method using Fuzzy logic

Fig.2 Proposed Method Fuzzy Expert System for Faculty Performance Evaluation

Evolution parameters: Based on the above discussion, Fuzzy Expert System considers the various elements of performance measures of teachers with different modules as shown in Table 1.

The fuzzy numbers are:

5- Excellent 4-Very good 3-Good
2-Average 1-Poor

Table 1 Parameters of the evaluation model

Table 1(a) Student Feedback Parameters

Representation of Fuzzy Variables	Fuzzy Variables
F1	**Feedback parameters (Grade/rank 1-5)**
F11	**Quality of teaching**
F111	Pace of subject
F112	Used good examples and illustrations
F113	Motivated to attend the classes
F114	Used blackboard efficiently
F115	Used audio visual aids like OHP, LCD, etc.
F116	Group discussion/seminar helped in learning
F117	Stimulated my interest in the subject
F118	Audibility and clarity of speech
F12	**Factors in learning**
F121	Lectures contributed to my learning
F122	Defined learning objectives for each period
F13	**Assessment of learning**
F131	Teacher's feedback on my assignments was useful
F132	Questions given in exams are from the topics taught
F133	Problem sets helped me learn
F134	I can apply the subject concepts
F135	Answer papers are evaluated fairly
F14	**Mentoring/counseling**
F141	Teacher was approachable outside the classes
F142	Teacher was sympathetic to academic/personal problems

Table 1(b) Teachers Self Appraisal Parameters

Representation of Fuzzy Variables	Fuzzy Variables
F2	**Teachers Self Appraisal**
F21	**Teaching**
F211	Preparation of course plan
F212	Preparation of class notes
F213	Syllabus coverage
F214	Quality and quantity of illustrations & examples
F215	Satisfaction level about your communication abilities
F216	Use of teaching aids like models /animations/ photographs, etc.,
F217	

F218	Frequency of using OHP/LCD to match with
F219	lesson requirements Average attendance percentage of students Innovation methods of teaching, if used(give details separately)
F22	**Assessment of learning**
F221	Level of student response to your
F222	questioning during class Average marks of class in the slip tests at the end of the class or class tests at the end of the
F223	unit(specify the number of tests conducted)
F224	Laying down learning objectives for each topic
F225	Organizing group discussions as per plan
F225	Conducting student seminars as per approved schedule Timely evaluation of assignments
F23	**Mentoring and counseling**
F231	Number of students met
F232	Time spent with each
F233	student Quality of outcome
F24	**Administrative Functions**
F241	Supportive role to HOD (attendance monitoring, upkeep of laboratories & manuals, addition of books to library, departmental files,
F242	timetables etc.) Supportive role to Principal (anti-ragging, dress code, discipline, industrial/educational tours etc.)
F25	**R&D functions**
F251	Papers published in international/National journals
F252	Participated in seminars /symposia
F253	Guidance of student
F254	projects Current research projects
F255	and progress during the period
F256	Seminars/symposia organized as convener/co-coordinator/secretary Current Published Textbooks

Table 1(c) Assessment by Peers Parameters

Representation of Fuzzy Variables	Fuzzy Variables
F3	**Assessment by Peers**
F31	**Provisional Qualities**
F311	Breadth & depth of knowledge of his/her subject
F312	Updating habits of subject knowledge
F313	Knowledge in related areas
F314	Comprehension skills
F315	Communication abilities
F316	Oral
F317	Written
F318	Application to work
F319	Lerner centered pedagogical skills
F31A	Academic planning and implementation
F31B	Preparation of class notes
F31C	Ability to guide student project work
F31D	Administrative support
F31E	R&D functions
F32	**Personal qualities**
F321	Punctuality
F322	Devotion of duty
F323	Integrity
F324	Capacity to work as a team member
F325	Interpersonal relations
F326	Emotional balance
F327	Intellectual honesty
F328	Mentoring/Counseling capability
F329	Fairness in students' evaluation

Table 1(d) Results and University Exams Parameters

Representation of Fuzzy Variables	Fuzzy Variables
F4	**Results and University Exams**
F41	**Subject-1**

F411	% Passes
F412	% 1st Classes(>59% <70% only)
F413	% Distinctions(>69% only)
F414	%Class average marks
F42	**Subject-2**
F421	% Passes
F422	% 1st Classes(>59% <70% only)
F423	% Distinctions(>69% only)
F424	%Class average marks
F43	**Subject-3**
F431	% Passes
F432	% 1st Classes(>59% <70% only)
F433	% Distinctions(>69% only)
F434	%Class average marks

% Passes Calculation:
- 5- Excellent, if >90% pass
- 4-Very good, if >80% & <70% passes
- 3-Good, if >70% & <60% passes
- 2-Average, if >60% & <50% passes
- 1-Poor, if <50% pass

% 1st Classes (>59% <70% only) Calculation:
- 5- Excellent, if >60% & <70% 1st classes,
- 4-Very good, if >40% & < 60% 1st classes
- 3-Good, if >20% & < 40% 1st classes
- 2-Average, if >0% & < 20% 1st classes
- 1-Poor, if 0 % 1st class

% Distinctions (>69% only) Calculation:
- 5- Excellent, if >75% distinctions in class strength,
- 4-Very good, if >55% & < 75% distinctions in class strength
- 3-Good, if >35% & < 55% distinctions in class strength
- 2-Average, if >0% & <35% distinctions in class strength
- 1-Poor, if 0 % distinctions in class strength

%Class average marks Calculation:
- 5- Excellent, if >60% Class Average
- 4-Very good, if >55% & < 60% Class Average
- 3-Good, if > 45% & < 55% Class Average
- 2-Average, if >40% & < 45% Class Average
- 1-Poor, if, <40% Class Average

V. FUZZY EXPERT SYSTEM FOR FACULTY PERFORMANCE EVALUATION

Performance Evaluation of faculty with Fuzzy Expert System comprised with three steps:

1. Identification of crisp value.
2. Fuzzification of input value.
3. Determination of application rules and inference method.
4. Fuzzy output overall performance value and Defuzzification of performance value.

1 Crisp Value (Data)

Teachers self-appraisal forms are filled in by respective teachers on the above elements with sub activity which then recommended by the Head of the Department and head of the institution with due verification. The Crisp data is tabulated from these forms (Table 7).

2 Fuzzification (Fuzzy Input Value)

The input variables (elements/parameters) are then divided into linguistic variables 5-Excellent,4-Very good, 3-Good, 2-Average, and 1-Poor. Membership functions are then formed assigning the proper range to respective linguistic variables. In this paper we have used the trapezoidal membership function for converting the crisp set into fuzzy set as in eqn. (1).

$$\mu_f(x) = \begin{cases} 0, & x < a \\ \frac{x-a}{b-a}, & a \le x \le b \\ 1, & b < x < c \\ \frac{d-x}{d-c}, & c \le x \le d \\ 0, & x > d \end{cases} \qquad (1)$$

Feed Back from Students

Table 2. Student's feedback

Year/Branch /Section (1)	Subject Taught (2)	Student Feedback(3)	Overall Student Feedback (%)(4)
B1	S1	F11	F1=Avg. points of Col. 3
		F12	
		F13	
		F14	

Range for linguistic variables of the Students Feedback (F1) is shown in Table 3.

Table 3. Students' feedback in terms of linguistic variables

Student Feedback	Poor	Avg	Good	V.Good	Excellent
F1	[1 1.2 6 1.6 26 2]	[1.5 2.08 2.46 3 2.8]	[2. 3 2.8 3.2 3.5]	[3 3.596 4.01 4.3]	[3.8 4.46 4.9 5]

Membership Function of the input variable Students Feedback (F1) is shown in Fig. 3.

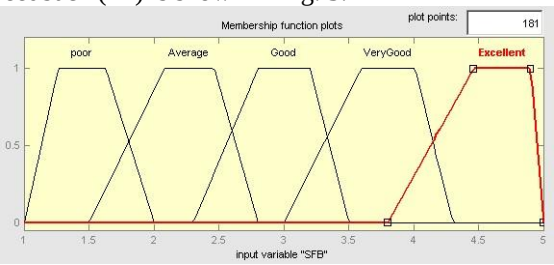


Fig. 3. Membership function of input variable F1

The remaining Membership Functions of the input variables like Teacher Self Appraisal (F2), Assessment by Peers (F3), and Results and University Exams (F4) are calculated same as the calculation of member function of F1. These results are produced using Fuzzy tool in mat-lab.

3 Fuzzy Rule and Inference Mechanism

The rules determine input and output membership functions that will be used in inference process. These rules are linguistics and are entitled "IF-THEN" rules. From the discussion with the academic experts some rules are formulated from their practical and past experiences. In this study since the number of input variables are more, more number of rules are framed to justify important variables of the Results and University Exam and the academic institute. Some of the rules for fuzzy system as shown below:

1. If (SFB(F1) is Poor) and (TSA(F2) is Poor) and (AP(F3) is Poor) and (RUE(F4) is Poor) then (Assessment Results(O) is Poor)
2. If (SFB(F1) is Average) and (TSA(F2) is Poor) and (AP(F3) is Poor) and (RUE(F4) is Poor) then (Assessment Results(O) is Poor)
3. If (SFB(F1) is Very Good) and (TSA(F2) is Poor) and (AP(F3) is Poor) and (RUE(F4) is Poor) then (Assessment Results(O) is Poor)
4. If (SFB(F1) is Poor) and (TSA(F2) is Average) and (AP(F3) is Average) and (RUE(F4) is Average) then (Assessment Results(O) is Average)
5. If (SFB(F1) is Very Good) and (TSA(F2) is Average) and (AP(F3) is Average) and (RUE(F4) is Average) then (Assessment Results(O) is Average)
6. If (SFB(F1) is Average) and (TSA(F2) is Average) and (AP(F3) is Average) and (RUE(F4) is Average) then (Assessment Results(O) is Average)
7. If (SFB(F1) is Very Good) and (TSA(F2) is Average) and (AP(F3) is Average) and (RUE(F4) is Average) then (Assessment Results(O) is Average)
8. If (SFB(F1) is Good) and (TSA(F2) is Good) and (AP(F3) is Good) and (RUE(F4) is Good) then (Assessment Results(O) is Good)
9. If (SFB(F1) is Poor) and (TSA(F2) is Good) and (AP(F3) is Good) and (RUE(F4) is Good) then (Assessment Results(O) is Good)
10. If (SFB(F1) is Very Good) and (TSA(F2) is Good) and (AP(F3) is Good) and (RUE(F4) is Good) then (Assessment Results(O) is Good)
11. If (SFB(F1) is Excellent) and (TSA(F2) is Good) and (AP(F3) is Good) and (RUE(F4) is Good) then (Assessment Results(O) is Good)
12. If (SFB(F1) is Very Good) and (TSA(F2) is Very Good) and (AP(F3) is Very Good) and (RUE(F4) is Very Good) then (Assessment Results(O) is Very Good)
13. If (SFB(F1) is Poor) and (TSA(F2) is Very Good) and (AP(F3) is Very Good) and (RUE(F4) is Very Good) then (Assessment Results(O) is Very Good)
14. If (SFB(F1) is Good) and (TSA(F2) is Very Good) and (AP(F3) is Very Good) and (RUE(F4) is Very Good) then (Assessment Results(O) is Very Good)
15. If (SFB(F1) is Excellent) and (TSA(F2) is Very Good) and (AP(F3) is Very Good) and (RUE(F4) is Very Good) then (Assessment Results(O) is Very Good)
16. If (SFB(F1) is Excellent) and (TSA(F2) is Excellent) and (AP(F3) is Excellent) and (RUE(F4) is Excellent) then (Assessment Results(O) is Excellent)
17. If (SFB(F1) is Very Good) and (TSA(F2) is Excellent) and (AP(F3) is Excellent) and (RUE(F4) is Excellent) then (Assessment Results(O) is Excellent)
18. If (SFB(F1) is Average) and (TSA(F2) is Excellent) and (AP(F3) is Excellent) and (RUE(F4) is Excellent) then (Assessment Results(O) is Very Good)
19. If (SFB(F1) is Poor) and (TSA(F2) is Very Good) and (AP(F3) is Very Good) and (RUE(F4) is Poor) then (Assessment Results(O) is Poor)

20. If (SFB(F1) is Average) and (TSA(F2) is Poor) and (AP(F3) is Poor) and (RUE(F4) is Average) then (Assessment Results(O) is Average)
21. If (SFB(F1) is Average) and (TSA(F2) is Good) and (AP(F3) is Good) and (RUE(F4) is Good) then (Assessment Results(O) is Good)
22. If (SFB(F1) is Very Good) and (TSA(F2) is Average) and (AP(F3) is Average) and (RUE(F4) is Excellent) then (Assessment Results(O) is Good)
23. If (SFB(F1) is Very Good) and (TSA(F2) is Poor) and (AP(F3) is Poor) and (RUE(F4) is Excellent) then (Assessment Results(O) is Good)
24. If (SFB(F1) is Excellent) and (TSA(F2) is Very Good) and (AP(F3) is Very Good) and (RUE(F4) is Good) then (Assessment Results(O) is Very Good)
25. If (SFB(F1) is Excellent) and (TSA(F2) is Average) and (AP(F3) is Good) and (RUE(F4) is Excellent) then (Assessment Results(O) is Very Good)

F1= Student Feedback(SFB).
F2=Teachers Self Appraisal(TSA)
F3= Assessment by Peers (AP)
F4= Results and University Exam (RUE)
O= Assessment Results(AR)

4 Fuzzy Output and Defuzzification

The output variable is the overall performance of the teacher, which has five linguistic Variables. The degree of membership functions is given by equation (2).

$$\mu_F(x) = \max_k[\min[\mu_A(f_1), \mu_B(f_2),]\mu_C(f_3) \ldots\ldots], where\ k = 1,2,3,\ldots\ldots r \quad (2).$$

This expression determines an output membership function value for each active rule. When one rule is active, an AND operation is applied between inputs. The fuzzy linguistic variables of output variable are shown in Table 4.

Table 4. Teachers' Overall Performance in terms of Linguistic Variable

Faculty's Overall Performance	Poor	Average	Good	Very Good	Excellent
O	[1 1.41 1.79 2.1]	[1.6 2.24 2.66 2.7]	[2.3 2.944 3.37 3.4]	[3 3.77 4.1 4.2]	[3.8 4.48 4.865]

Membership Function of the output variable Overall Performance of a Faculty (O) is shown in Fig. 4

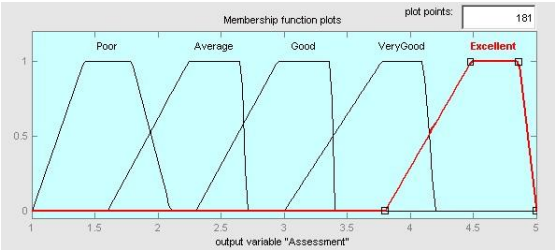


Fig. 4. Membership function of teachers overall performance

Calculation of Performance Value:

After completing the fuzzy decision process, the fuzzy number obtained must be converted to a crisp value. This process is known as Defuzzification. In this paper, a centre gravity of area technique was applied is called Centroid technique, which is one of the most common methods for converting from fuzzy number to crisp values [15]. The centroid defuzzification technique can be expressed for the calculation of crisp value:

$$x^* = \frac{\sum_{i=1}^{n} \mu_i(x)x}{\sum_{i=1}^{n} \mu_{i(x)}\, x} \quad (3)$$

where x^* is the defuzzified output, $\mu_i(x)$ is the aggregated membership function and x is the output variable. Using this method the observation results was computationally easier and got accurate results.

Rule viewer of the proposed fuzzy expert system for the evaluation of overall faculty's performance is shown in Fig. 5.

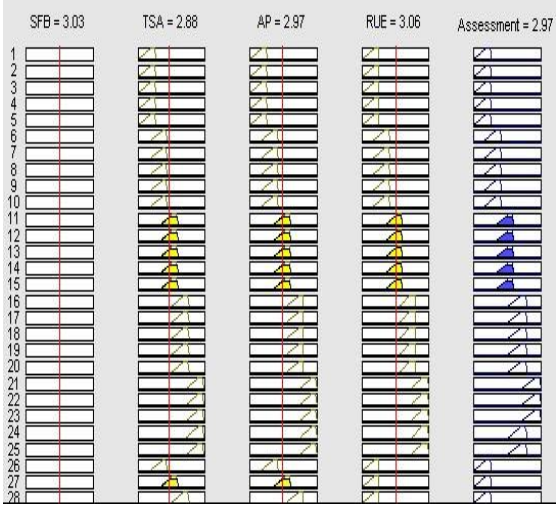


Fig. 5. Rule Viewer of fuzzy expert system

Surface viewer of proposed fizzy expert system for academic performance evaluation is shown in Fig. 6.

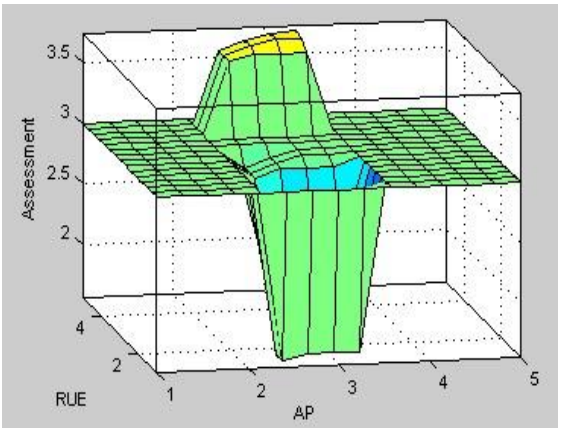


Fig. 6. Surface Viewer of Fuzzy Expert System

VI. RESULTS AND DISCUSSIONS

Experiments are carried out using Mat-lab fuzzy toolbox on Windows XP platform.

The proposed Fuzzy Export model was studied and tested with 50 faculties data obtained in the year 2013 from repudiated engineering college, Vignan's Institute of Information Technology, Visakhapatnam. Table 5 shows the 10 faculty's data of both the traditional and fuzzy score. From the input data the output variable overall performance of teacher is determined by traditional method (based on statistical averaging method) and also by using the fuzzy model developed in the study. Last two columns of Table 5 shows the values of teachers overall performance by traditional method and Fuzzy Expert System respectively.

Table 5. Teachers overall performance (crisp and fuzzy)

S. No.	Input Variables(F)				Output (O)	
	F1 SFB	F2 TSA	F3 AP	F4 RUE	Traditional	Fuzzy
01	4	4	2	5	3.75	4.063
02	4	5	5	5	4.75	4.78
03	5	5	1	4	3.75	4.46
04	4	5	2	5	4	4.37
05	**5**	**3**	**1**	**4**	**3.25**	**3.92**
06	5	4	1	5	3.75	4.46
07	3	4	3	4	3.5	3.57
08	1	3	3	5	3	3.66
09	2	4	3	3	3	3.16
10	4	5	5	3	4.25	4.41

We observed the difference in the direct value and the values determined by using fuzzy model. Using traditional method in 5th record has the value 3.25 i.e. 3 indicates the grade as good, but in the case of fuzzy is 3.92 i.e 4 graded as very good. So the overall performance of a faculty determined by fuzzy model is more realistic than the direct values.

VII. CONCLUSIONS

Teachers' regular assessment is suggested to maintain quality in higher education. There is a vast potential of the applications of fuzzy expert system in teachers' assessment. Expert system technology using Fuzzy Logic is very interesting for quantitative and qualitative facts evaluation. In this paper a model of Fuzzy Expert System is proposed to evaluate teachers overall performance on the basis of various related activities. The qualitative variables are mapped into numeric results by implementing the fuzzy expert system model through various input examples and provided a basis to use the system for further decision making. In this way the teaching staff is encouraged to reflect on quality, adequacy, satisfaction, efficiency and innovation in teaching in the technical academic institutions.

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