PERFORMANCE ASSESSMENT OF FACULTY FOR INSTITUTE GRADATION USING DATA MINING TECHNIQUES


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ABSTRACT:

The spectrum of applications of Educational Data Mining to industrial and commercial problems is so wide as to defy easy characterization. In this paper a holistic framework is proposed based on the psychological conceptions of human competence and performance in the workplace. We explain the application of Data Mining that can be used in an institute to systematically assess existing and future competencies required. Using this approach, Educational Institute will be able to more effectively use their resources to reap more benefits from their investments in both people and technology. The objective of this research is to develop a prototype of a system that can be used by academic advisors in their academic planning. Performance appraisal of employee is important in managing the human resource of an organization. With the change towards knowledge-based capitalism, maintaining talented knowledgeable workers is critical. The appraisal process describes a human resource methodology that is frequently used for both employee appraisal and employee development. The appraisal may further be utilized for assessing the department in which a faculty is associated with and can also be used for the institute gradation. The appraisal is a comprehensive method where in the feedback about the employee comes from all the sources that come into contact with the employee on his/her job. The respondents for an employee can be her/his peers, subordinates team members, students, seniors and others. The proposed system is an attempt to implement the feedback based appraisal system in academics especially engineering colleges.

Keywords: Performance appraisal system, Institute gradation, Educational Institute, Formative Assessment, Summative Assessment
[I] INTRODUCTION

Assessment as a dynamic process produces data, which acts as a performance indicator for an individual. The evaluation of instructors’ performance is especially relevant for the academic institutions as it helps to formulate efficient plans to guarantee quality of instructors and learning process. Effort in this work is directed at modeling an intelligent technique for evaluation of instructors’ performance, propose an optimal algorithm and designing a system framework suitable for predicting instructors’ performance. The assessment is made on a questionnaire specially designed to measure performance of their professionalism. The data mining methodology used for extracting useful patterns from the institutional database is able to extract certain unidentified trends in teacher’s performance when assessed across several parameters.

Academic institutions regularly generate huge data on students, courses, faculty, staff that includes managerial systems, organizational personnel, lectures details and so on. This useful data serves as a strategic input to any academic institution for improving the quality of education process. Today in the changing global scenario where the knowledge and technology is expanding rapidly giving rise to the talent crunch, it is the need of the hour to find out the competencies that can help to adopt the institutes to remain competitive. Depending on the performance, students seeking admissions will be able to select any institute and branch of their choice. Further this will also create a healthy competitive culture among various Educational Institutes in an area and they will strive for improving their performance.

Performance appraisal is a formal management system that provides for the evaluation of the quality of an individual’s performance in an organization. As mentioned by Dessler.G [5], performance appraisal has the means to evaluate an employee’s current and past performance relative to the employee’s performance standards. It is a process which involves creating work standards; evaluate employee’s actual performance relative to those work standards; and giving feedback to employee so as to motivate him or her to improve the job performance or to eliminate performance deficiency. In addition to that, Terrence, H. M and Joyce, M. [11] stated that, some potential aims of performance appraisal might include identifying particular behavior or job.

In this work, a data mining based model guided by instructors evaluation principles using data mining techniques is presented, focuses at addressing the following: modeling an improved instructors’ performance evaluation technique by integrating Formative and Summative evaluation methods, propose an optimal algorithm and design a framework of instructors’ evaluation system suitable for predicting instructors’ performance and as well as recommend necessary action to be taken in order to aid an Institute administrators in decision making. We have presented a model using Data Mining approach for academics. This will be useful to help institutions for managing competencies of the faculties, performance assessment, understand the students’ learning [10].

[2] RESEARCH APPROACH AND FINDINGS

The research literature related to Institutional management was studied extensively. It helped us to comprehend the need for Performance Evaluation in educational institutions. Many Systems are designed nowadays and they are often used as Human Resource tools which help to manage the data repositories. By observing the above related work we feel that there are very systems that has the capacity to integrate the decision making process with human reasoning and thinking. There are many works in this area. On improving the performance of students and improve the
curriculum and what is reflected in the educational process and on improving teacher performance.

Mardikyan and Badur[1] study investigates the factors associated with the assessment of instructors teaching performance using two different data mining techniques; stepwise regression and decision trees. They show that a small average relationship exists between learning and the evaluations but not applicable to all teachers. The employment status of the instructor that is not included in the questionnaire is found to be significant. The most important factor to explain the instructors’ teaching performance is the instructor attitudes that are primarily measured by the evaluation process.

Ajay Pal [2] proposed in his paper to perform an analysis considering number of parameters for the derivation of performance prediction indicators needed for teachers performance evaluation. The aim is to predict the quality, productivity and potential of faculty across various disciplines which will enable higher level authorities to take decisions and understand certain patterns of teacher’s motivation, satisfaction, growth and decline.

Baradwaj and Pal [3] used classification task to evaluate student's performance. The decision tree method is used also for predicting student performance. By this task they extract knowledge that describes students' performance in final semester examination. It helps earlier in identifying the dropouts and students who need special attention to reduce failure ration and allow the teacher to provide appropriate advising or to provide counseling and taking appropriate action for the next semester examination.

Ola and Pallaniappan [6] used directed modeling an intelligent technique for evaluation of instructors’ performance in higher institutions of learning, and proposed an optimal algorithm and designed a system framework which is suitable for predicting instructors' performance. The proposed system, if fully implemented, will aid school administrators in decision making, provide basis for instructors' performance improvement that will optimize students' academic outcomes and improve standard of education.

Ahmadi and abadi [7] analyzed the performance of final Teacher Evaluation of a semester of a college and presented the result which is achieved using WEKA tool. Data used in this study were 104 records on teacher’s behaviors in classroom with data mining algorithms such Association Rule and decision trees (j48). At teacher's evaluation, evaluation's score of students is very important factor.

Randa Kh. Hemaid [8] examines the factors associated with the assessment of teacher's performance and suggests ways to improve it, good prediction of training course that will be obtained by teacher in one way to reach the highest quality in teacher performance.

Pooja Tripathi [9] suggested a framework for effective educational process using Data Mining techniques to uncover the hidden trends and patterns and making accuracy based predictions through higher level of analytical sophistication in students. The goal of this paper is to develop a framework that helps the academic deans and others in their advising capacity to take decisions in building strategies for the Institute Development and Management.

We feel that institutes like any other organization have their own challenges. Developing an effective way for managing can enable an institute to build stronger links between departments while providing timely input into the decision making process. The basic human resource component in educational institute is faculties, supporting staffs, team heads, and training and development staffs. This area has got relatively very little attention but has shown a wide scope. We feel that organizations are facing a huge talent crunch i.e. there is a gap between what they
have and what the market requires. They are unable to utilize the tacit and explicit knowledge of their employees. So we feel that the educational institute should take substantial efforts in implementing the technical education which can help the students by not only developing them with all necessary skills and habits but also willingness for lifelong learning.

[3] PROPOSED METHODOLOGY

Various techniques or methods have been used by human resource management experts to evaluate the performance of an employee. With all the available techniques, it is essential to understand that different organization might use different technique in assessing staff performance. Since all the techniques mentioned above has their own advantages and disadvantages, most organizations might mix and match different techniques for their own performance appraisal system that can fulfill their organizational needs. Performance appraisal system has become one of the most valuable management tools which organization members use to achieve collective goals. In order to ensure that the results of the performance appraisals are useful and reasonable to the superior when evaluating their subordinates, it is important for the performance appraisal system to consistently produce reliable and valid results for the management of the institute.

We propose a model where all the characteristics related to evaluation of performance of a faculty at an educational institute is considered. First aspect of evaluation is the faculty’s teaching skills which we have in the form of feedback from students also stated as Formative Evaluation. A set of Questionnaire is developed for analyzing this and the students will assess the faculty accordingly. This assessment by students is also dependent on multiple aspects of students as well viz. their performance in Internal and External Exams, their attendance, their regularity of attending lectures and practical work etc.

Second aspect of evaluation is Summative Assessment, which takes into consideration the professional and research aspect of the faculty, their involvement in institutional development, their inclination in assisting any work related to University work where the parent institute is affiliated etc. Again a set of Questionnaire is prepared which need to be answered by the faculty for this type of assessment.

In the third and final aspect for assessment of faculty, we need to take feedback of faculty from the seniors (this includes Head of Department and Institute), feedback from management personnel and self-assessment of the faculty.

An attempt is made to first identify the relevant data needed to suitably measure the performance score under each sub-head. A suitable metric is then proposed, based on these data, and the overall score of the faculty is calculated. A method is generated to evaluate and grade them among its peers. And also to rank and grade one department with another in an institute depending on the ranking of the faculty in the department. A thought can also be given to rank/grade one institute with all those institutes who are affiliated to same university. This will definitely assist student seeking admission and their parents to decide which institute and which Branch they should select for competing with Global Education. The institutes can then be rank-ordered based on their scores either department wise or overall.

A suitable weight (between 0 and 1) needs to be given to these basic parameters for assessing the performance. These weights when multiplied by the marks assigned to the parameters will result in the marks of those specific parameters. Finally we need to add up the marks of all the parameters to find out the overall marks/Grade of the institute.
FORMATIVE ASSESSMENT

Formative Evaluation refers to a quantitative evaluation of the instructors aimed at identifying strengths, weaknesses and providing adequate professional development opportunities. It involves the use of classroom observations, student evaluation reports, etc., to measure the performance and effectiveness of an instructor. Formative faculty peer reviews of teaching are assessments of the teaching efforts of a faculty member by the colleagues in his or her scholarly field, unit, school, or college, which are done with the primary goal of improving an individual's teaching efforts and the resulting student learning. In this, a data mining-based model that is guided by instructors' evaluation principles using data mining techniques is presented, that focuses on modeling an improved instructors' performance evaluation technique and propose an optimal algorithm and design a framework of instructors' evaluation system suitable for predicting instructors' performance.

4.1 Methodology of Formative Assessment

In this process, we have used a questionnaire to collect the real data from the students that describes the relationship between learning behavior and their academic performance. And also we collected the Faculty (or teacher) feedback from the students.

A. Students Dataset

There is a work methodology which governs our work. Since students are expected to give the feedback, therefore it is essential that their performances are also to be taken into account for a practical assessment of any faculty. As a student who is absent during the tenure of entire semester will not be able to assess the faculty performance fairly compared to a student who has attended lectures seriously. The variables for judging the learning and academic behavior of students used in the questionnaire are Attendance, Assignment work, performance in Internal exams. Sessional marks and previous year results. We grouped all grades into five possible values they are Excellent, Good, Average, Poor and fail which are shown in the table 1.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
<th>Possible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance in lectures and Labs</td>
<td>Attendance in one Sem in Classrooms and Labs</td>
<td>Excellent, Good, Average, Poor</td>
</tr>
<tr>
<td>Assignment Grade</td>
<td>Work given by the teacher and completed by Student</td>
<td>Excellent, Good, Average, Poor</td>
</tr>
<tr>
<td>Performance in Internal exams.</td>
<td>How the student performed in Internal/Class Test in current semester</td>
<td>Excellent, Good, Average, Poor, Fail</td>
</tr>
<tr>
<td>Sessional marks</td>
<td>Category of marks obtained in internal exam.</td>
<td>Excellent, Good, Average, Poor, Fail</td>
</tr>
<tr>
<td>Previous year/Semester results</td>
<td>Category of marks obtained in previous year/semester exam</td>
<td>Excellent, Good, Average, Poor, Fail</td>
</tr>
</tbody>
</table>

The methodology starts from the problem definition, then data collection from Students Database. Our main motive is to categorize students in two categories whether they will be able to give a
realistic feedback or not. As from realistic feedback will be able to assess the performance of the teachers teaching them the courses.

**Association**

Association Data Mining aims at analyzing the data to identify an occurrence of events. Here, Association rules are applied to evaluate student behavior. Association rules are nothing but mining for interesting relationships among items in a given data set. Essentially, association mining is about discovering a set of rules that is shared among a large percentage of the data. Association rules mining tend to produce a large number of rules. The goal is to find the rules that are useful to users [15]. Here Student Data set Association Rule (SDAR) mining is used to identify possible grade values. i.e., Excellent, Good and Average (Whose feedback will be useful for faculty performance evaluation), Poor or Fail (whose feedback may not be of much significance) as:

- \([\text{Attend} = \text{Good, Assign} = \text{Good, Internal Perform} = \text{Avg.}] \Rightarrow [\text{Grade} = \text{Good}]\)
- \([\text{Attend} = \text{poor, Assign} = \text{poor, Sessional Marks} = \text{poor}] \Rightarrow [\text{Grade} = \text{Poor}]\)

The Association rule’s result depicts a sample of discovered rules from data for student with different grades along with their support and confidence.

A Rule-Based Classification (RBC) extracts a set of rules that show relationships between attributes of the data set and the class label.[11]

A set of IF-THEN rules are used for classification.

- If \(\text{Int.Perf.} = \text{Excellent And Attend.} = \text{Excel. And Sessional} = \text{Excellent And Assign.} = \text{Good And Prev. Results} = \text{Excellent, then Excellent}, \text{i.e. Realistic Feedback .}\)
- If \(\text{Attend.} = \text{Good And Int. Perform.} = \text{Good And Sessional marks=Good And Assign=Good And Prev. Results=Excellent, then Good.i.e. Good Feedback}\)

Association rules are characteristic rules (it describes current situation), but classification rules are prediction rules for describing future situation.

**B. Teacher Dataset**

Teachers’ performance [14] is evaluated using data mining techniques in this paper. Initially a survey of the teachers’ requirements and students' requirements is made. Then we interacted with the teachers and got some knowledge about their methods. We met different teachers that have been given some ideas about the finding of the teacher’s performance.

1. **Data Preparations**

   For this study, Feedback from the students’ were collected from B.Tech., students of an Engineering College from various branches. The profile of students is defined based on the academic and cultural backgrounds of students. The students’ academic background is measured using the entry requirements to be fulfilled for admission in the university/ college.

2. **Data Selection and Transformation**

   In this stage only the data required for data mining are selected. A few derived variables were selected. From the available database, some of the information for the variables is collected. The data collected from Feedback forms and database is shown in Table.

   Several attributes have been asked for in the questionnaire that might predict the performance class. The list of the collected attributes is presented in Table 2.
<table>
<thead>
<tr>
<th>Attributes</th>
<th>Description and Short Forms</th>
<th>Possible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher ID</td>
<td>Unique ID of Every Teacher</td>
<td>To be written by Every Student</td>
</tr>
<tr>
<td>Name</td>
<td>Lecturer Name</td>
<td></td>
</tr>
<tr>
<td>Branch</td>
<td>Select Among the Different Branches</td>
<td></td>
</tr>
<tr>
<td>Semester</td>
<td>Year and Semester of feedback</td>
<td></td>
</tr>
<tr>
<td>Subject</td>
<td>Name of subject</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td>Presentation of Lectures-PL</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F2</td>
<td>Communication Skills-CS</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F3</td>
<td>Content Delivery-CD</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F4</td>
<td>Explanation Power-EP</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F5</td>
<td>Subject Knowledge-SK</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F6</td>
<td>Prepares and Updates Lecture notes of all Units- PLN</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F7</td>
<td>Doubts Clearing-DC</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F8</td>
<td>Encourages Students in earning-ESL</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F9</td>
<td>Gained Knowledge from Lectures-GKL</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F10</td>
<td>Assignment Regularity-AR</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F11</td>
<td>Overall Completion of Syllabus-OCS</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F12</td>
<td>The staff approach towards Internal assessment is justified- SIAJ</td>
<td>{1,2,3,4,5}</td>
</tr>
<tr>
<td>F13</td>
<td>Problem Discussion-PD</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F14</td>
<td>Revision of Previous Lectures-RPL</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F15</td>
<td>Explanation with Practical Examples-EPE</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F16</td>
<td>Solved Previous year Paper-SPP</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F17</td>
<td>Evaluation of Assignment-EA</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F18</td>
<td>Discussion of Assignment Questions-DAQ</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F19</td>
<td>Students feel free to contact to ask Doubts-SFFD</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F20</td>
<td>Friendly Attitude-FA</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F21</td>
<td>Problem Solving on Completion of each Chapter-PSC</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F22</td>
<td>Correlate Theory with Practical-CTP</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F23</td>
<td>Use Innovative Teaching –Learning methods - ITLM</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F24</td>
<td>Staff should teach in higher semester as well</td>
<td>{1=Yes;0=No}</td>
</tr>
<tr>
<td>F25</td>
<td>Overall Evaluation of Staff - OES</td>
<td>{1,2,3,4,5}</td>
</tr>
</tbody>
</table>

**Table 2: Questionnaires for Formative Assessment**

The Survey uses Likert Scale (is a psychometric scale commonly involved in research that employs questionnaires.) It is the most widely used approach to scaling responses in survey research, such that the term (or more accurately the Likert-type scale) is often used interchangeably with rating scale, even though the two are not synonymous). After the questionnaire is completed, each item may be analyzed separately or in some cases item responses may be summed to create a score for a group of items.

After the questionnaires were collected, the process of preparing the data was accomplished. First, the information in the questionnaires has been transferred. F25. Which asks about the overall performance of the Lecturer is significant among the others.
The question set consists of two parts, the first set of twelve questions, where the sum of all these need to be added and the second set where the performance need to be evaluated using association rules and decision tree method. For evaluating the performance of the lecturer from the first set of questions, the summation of all the students (whose feedback may be useful) is divided by the no. of students giving feedback.

So the formula for performance will be

$$FP(x) = \frac{1}{2} \sum_{i=1}^{N} \left( \sum_{j=1}^{12} \frac{Value_{Q24i} + Value_{Qj}}{N} \right)$$

where ‘N’ is the number of students giving feedback.

This can be stated as: The performance of a faculty ‘X’ is one half times the sum of its performance for Q24 and its performance summation for the remaining questions (ie. Q1,....,Q12) given by the students .This no. will be an integer ranging from 1-5. Accordingly, the faculty can be classified as Expert (5), Very Good (4), Good (3), Needs Improvement (2) and Poor Performance (1) by the students.

For the second set, rule induction method and decision tree algorithm need to be applied for evaluating performance. These files are prepared and converted to (ARFF) format to be compatible with the WEKA data mining toolkit (Witten et al., 2011), which is used in building the model.

From the above faculty data, teacher.arff file was created, and then this file was loaded into WEKA explorer. WEKA processes data sets that are in its own ARFF format. This contains a selection of data files in ARFF format.

```xml
@relation Faculty_Performance.Symbolic
@attribute Overall_Evaluation{1,2,3,4,5}
@attribute Lecture_Presentation{1,2,3,4,5}
@attribute Communication_Skills{1,2,3,4,5}
@attribute Content_Delivery{1,2,3,4,5}
@attribute Explanation_Power{1,2,3,4,5}
@attribute Subject_Knowledge{1,2,3,4,5}
@attribute Doubts_Clearing{1,2,3,4,5}
@attribute Encourages_Students{1,2,3,4,5}
@attribute Gained_Knowledge{1,2,3,4,5}
@attribute Assignment_Regulariry{1,2,3,4,5}
@attribute Syllabus_Completion{1,2,3,4,5}
@attribute Problem_Discussion{1,0}
@attribute Previous_Topic_Discussion{1,0}
@attribute Explanation_with_Examples{1,0}
@attribute Solved_paper{1,0}
@attribute Assignment_Evaluation{1,0}
@attribute Assignment_Discussion{1,0}
@attribute Friendly_Attitude{1,0}
@attribute Problems_After_Chapters{1,0}
@attribute Theory_with_Practical{1,0}
@data
4,3,2,4,2,3,2,1,3,5,4,1,1,1,0,1,0,1,0,1,1,0,0,1
1,3,2,4,2,3,2,1,3,4,1,0,0,0,1,0,1,0,0,0
```
A decision tree is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility. It is one way to display an algorithm.

Decision trees are commonly used in operations research, specifically in decision analysis, to help identify a strategy most likely to reach a goal.

To Construct the Decision Tree, we use following method

1. Select a variable of training samples as nodes; create a branch to every possible value of the variables. Accordingly, the training sample set is divided into several sub-sets.

2. Do the same method to each branch, Training sample is the subset corresponding to the branches and one of the subsets which its parent node is divided into. When the node of all the training samples belongs to the same classification, or no remaining attributes can be used to further divide, Or the branch does not have samples, stop splitting the node branching and make it a leaf node.

**Fig - 1** A portion of The Decision Tree Generated

Decision tree is a classifier in the form of a tree structure where each node is either:

- A leaf node- indicates the value of the target attribute
- A decision node- specifies some test to be carried out on a single attribute-value, with one branch and sub-tree for each possible outcome of the test.
Selection of the attribute is done by using method Information gain. To create tree, we need to find information gain value for each attribute.

Gain is calculated for the attributes and the attribute having maximum gain will be selected as root node. Next step, we need to expand the root node and move ahead

The prioritization of the faculty’s qualitative parameters using decision tree have been visualized in Fig.3. Lecture Presentation is taken as root node from which Communication Skills and Explanation Power as branch node and so on.

The knowledge represented by decision tree can be extracted and represented in the form of IF-THEN rules.

Some of the rule set generated by the decision tree will be as follows:

1. IF PL = "4" AND CS = "4" AND CD = "3" AND EP = "3" AND SK = "5" AND EPE = "1" AND SPP = "1", THEN Overall Performance = "Expert".
2. IF PL = "5" AND CD = "4" AND EP = "3" AND SK = "4" AND ESL = "3" AND RPL = "1" AND SPP = "1", THEN Overall Performance = "Expert".
3. IF CS = "4" AND CD = "3" AND EP = "4" AND SK = "3" AND ESL = "3" AND RPL = "1" AND EPE = "1", THEN Overall Performance = "Very Good".
4. IF SK = "3" AND CD = "2" AND GKL = "2" AND OCS = "3" AND ESL = "3" AND EPE = "1" AND EA = "0", THEN Overall Performance = "Very Good".
5. IF CS = "2" AND EP = "2" AND SK = "3" AND ESL = "2" AND OCS = "3" AND RPL = "1" AND EPE = "1" AND EA = "0", THEN Overall Performance = "Good".

And So On……..

Efficiency of these rules depending variety of datasets and statistical examples can vary. But data mining tools such as WEKA as showed in this paper can conclude range results that help education directors in universities. These results will be used by directors in decision-making.

[5] SUMMATIVE ASSESSMENT

While Summative Assessment is described as an indispensable source of documentation and recognizable way to evaluate instructors’ quality, in order to measure aptitude and knowledge to ensure that required standards are met. It is used to determine the worth and career advancement of an instructor. It deals with the professional development of a faculty, his research advancements, journal contributions and many others which assist him in his overall professional development besides classroom teaching. Summative faculty peer reviews of teaching are assessments of the teaching efforts of a faculty member by colleagues in his or her scholarly field, unit, school, or college, which are done to compare or rank that individual within a unit or profession for the purpose of personnel decisions such as appointment, promotion, tenure etc.

Data Set and questionnaire

Performance appraisal system is basically a formal interaction between an employee by management conducted periodically to identify the areas of strength and weakness of the employee. The objective is to be consistent about the strengths and work on the weak areas to improve performance of the individual and thus achieve optimum process quality [13]. For this research, teacher’s Summative performance is evaluated. First a survey of the teachers'
requirements is made. Then we interact with the teachers and got some knowledge about their methods. We should meet different teachers that have been given some ideas about the finding of the teacher's performance. For this study data were collected from graduate studies at different department in the college of engineering over three years period of the same set of faculty for the purpose of investigating how their professional improvement has taken place during this tenure.

The dataset proposed to be collected from the faculty in the form of a questionnaire so as to evaluate their performance:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Attributes</th>
<th>Description</th>
<th>Possible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Name</td>
<td>Faculty's Name</td>
<td>Text</td>
</tr>
<tr>
<td>S2</td>
<td>Design. and Dept.</td>
<td>Prof. P-5, Asso. Prof AP-4, Selection Grade SG-3, Senior Lecturer SL-2, Lecturer L-1</td>
<td>Text</td>
</tr>
<tr>
<td>S3</td>
<td>Qualification and Exp.</td>
<td>Doctorate, Master, Bachelor, Diploma and Certificate</td>
<td>Text and Numbers</td>
</tr>
<tr>
<td>S4</td>
<td>UE-PS</td>
<td>University Examinations Paper Setting</td>
<td>{1=yes,0=No}</td>
</tr>
<tr>
<td>S5</td>
<td>UE-PE</td>
<td>University Examinations Paper Evaluation</td>
<td>{1=yes,0=No}</td>
</tr>
<tr>
<td>S6</td>
<td>UE-SE</td>
<td>University Examination Sessional Evaluation</td>
<td>{1=yes,0=No}</td>
</tr>
<tr>
<td>S7</td>
<td>UE-ID</td>
<td>University examinations Invigilation Duty</td>
<td>{1=yes,0=No}</td>
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<tr>
<td>S8</td>
<td>COE</td>
<td>Conduct of University Exams i.e. In-charge of Exam cell</td>
<td>{1=yes,0=No}</td>
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<tr>
<td>S9</td>
<td>GOP</td>
<td>Guidance of Project for Undergraduate and Graduate Students</td>
<td>{1=yes,0=No}</td>
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<tr>
<td>S10</td>
<td>EOP</td>
<td>Evaluation of Project/ Dissertation work for Undergraduate and Graduate Students</td>
<td>{1=yes,0=No}</td>
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<tr>
<td>S11</td>
<td>RA-W/S</td>
<td>Research Activity: Workshop Attended</td>
<td>{1=yes,0=No}</td>
</tr>
<tr>
<td>S12</td>
<td>RA- STTP</td>
<td>Research Activity: Training Programs Attended</td>
<td>{1=yes,0=No}</td>
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<tr>
<td>S13</td>
<td>RA-CPP</td>
<td>Papers presented at Conferences</td>
<td>{1=yes,0=No}</td>
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<tr>
<td>S14</td>
<td>RA-JPP</td>
<td>Papers published in Journals (Specify ISSN No.)</td>
<td>{1=yes,0=No}</td>
</tr>
<tr>
<td>S15</td>
<td>RA-T/C</td>
<td>Textbooks/Chapters written</td>
<td>{1=yes,0=No}</td>
</tr>
<tr>
<td>S16</td>
<td>RA-O</td>
<td>Organized seminar, conference, workshop(Organizer, coordinator, session chairperson, judge plz. specify)</td>
<td>{1=yes,0=No}</td>
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<tr>
<td>S17</td>
<td>PS-M</td>
<td>Professional Societies Membership</td>
<td>{1=yes,0=No}</td>
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<tr>
<td>S18</td>
<td>IGL</td>
<td>Involvement in Guest Lectures</td>
<td>{1=yes,0=No}</td>
</tr>
<tr>
<td>S19</td>
<td>ICA</td>
<td>Involvement in co-curricular activities viz. Sports, newsletter</td>
<td>{1=yes,0=No}</td>
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<tr>
<td>S20</td>
<td>DW-DL</td>
<td>Departmental Work, Development and In-charge of Labs</td>
<td>{1=yes,0=No}</td>
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<td>S21</td>
<td>DW-MP</td>
<td>Departmental Work; Academic Manual Preparations</td>
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<tr>
<td>S22</td>
<td>DW-TT</td>
<td>Departmental work; Timetable preparation, Departmental Library In-charge</td>
<td>{1=yes,0=No}</td>
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<tr>
<td>S23</td>
<td>DW-CR</td>
<td>Departmental Work; Class Representative, Technical Visit</td>
<td>{1=yes,0=No}</td>
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<td>S24</td>
<td>CEA</td>
<td>Involvement in consultancy and extension activities.</td>
<td>{1=yes,0=No}</td>
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<td>S25</td>
<td>HAR</td>
<td>Honors/Rewards received.</td>
<td>{1=yes,0=No}</td>
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<tr>
<td>S26</td>
<td>IPC</td>
<td>Any other improvement of Personal Competence viz. M.E. Co-coordinator, Departmental Result Analysis In charge</td>
<td>{1=yes,0=No}</td>
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</table>

**Table 4. Questionnaires for Summative Evaluation**

In all the answers from Question 4 onwards the faculty needs to mention the frequency of work done. In other words how many times he has done the task assigned since last three years. If needed they can add comments as well in the end of the questionnaire.

Next step we need those fields that are required for data mining. We need to collect data for preparing the model. This includes pre-processing or extracts important information from it and then create proper format file of the data like in weka.arff file format.
Architecture of the proposed system

In this study, we have done a survey of faculties of different departments in an engineering college at Mumbai, affiliated to Mumbai University for study and finding the performance. Weka is open source software that implements a large collection of machine leaning algorithms and is widely used in data mining applications. From the above data, teacher.arff file was created. This file was loaded into WEKA explorer. The classify panel enables the user to apply classification and regression algorithms to the resulting dataset, to estimate the accuracy of the resulting predictive model, and to visualize erroneous predictions, or the model itself. It uses GNU general public licenses and is freely available on following link: http://www.cs.waikato.ac.nz/~ml/weka [14].

5.1 The Explorer Interface of WEKA

WEKA processes data sets that are in its own ARFF format. Conveniently, the download will have set up a folder within the WEKA-3.6 folder called “data”. This contains a selection of data files in ARFF format.

![Fig. 3: GUI Interface of WEKA](image)

5.2 Create Data File in ARFF format

The first step required is to collect the data and prepared it as per specific format. The most preferable format for the weka is .arff (Attribute Relation File Format) format which can be written like below.
The file consists of three parts: relation, attribute and data. The @relation line gives the dataset a name for use within Weka. The @attribute lines declare the attributes of the examples in the data set (Note that this will include the classification attribute). Each line specifies an attribute’s name and the values it may take. In this paper the attributes have nominal values so these are listed explicitly. In other cases attributes might take numbers as values and in such cases this would be indicated. The @data represents lists with actual examples, in comma separated format; the attribute values appear in the order in which they are declared above.

5.3 Opening a Data Set in WEKA

We can open file directly from double clicking on it. Also we can open weka, select explorer, we can open file from open file button and then select the specific file.
This is a ‘Teacher evaluation’ data set, like the ones used in class for demonstration purposes. In this case, the normal usage is to learn to predict the ‘Acceptation’ attribute from four others providing information about the Teacher evaluation. Right click on result list and select option *visualize tree.*

Despite the implementation method adopted, most decision tree algorithms in literature are constructed in two phases: tree growth and tree pruning phase. Tree pruning is an important part of decision tree construction as it is used improving the classification/prediction accuracy by ensuring that the constructed tree model does not over fit the data set (Mehta et al, 1996). In this study we focused on serial implementation of decision tree algorithms which are memory resident, fast and easy to implement compared to parallel implementation of decision that is complex to implement. The disadvantages of serial decision tree implementation is that it is not scalable (disk resident) and its inability to exploit the underlying parallel architecture of computer system processors. From the Decision tree Association Rules can be generated. The discovery of interesting association relationships among large amounts of business transactions is currently vital for making appropriate business decisions. There are currently a variety of algorithms to discover association rules. Essentially, association mining is about discovering a set of rules that is shared among a large percentage of the data. Association rules mining tend to produce a large number of rules. The goal is to find the rules that are useful to users.

A few rules which are discovered are:

1) If [Designation = Prof.] And [Qualification = Doctorate] And [Experience> 10 Yrs.] And [Score =Best] ; Then: Exceptionally Good Prof.

2) If [Designation = Prof.] And [Qualification = Doctorate] And [Experience> 6 Yrs.] And [Score =Best] ; Then: Superior Prof.

3) If [Designation = Asso.Prof.] And [Qualification = Masters] And [Experience> 8 Yrs.] And [Score =Best] ; Then: Exceptionally Good Asso. Prof.

4) If [Designation = Asso.Prof.] And [Qualification = Masters] And [Experience> 4 Yrs.] And [Score = Good] ; Then: Successful Asso.Prof.

5) If [Designation = Sen. Lect.] And [Qualification = Grad.] And [Experience> 10 Yrs.] And [Score = Excellent] ; Then: Outstanding Sen.Lect.
[Score = Best] ; Then: Exceptionally Good
Sen. Lect..


Here we have done the following Assumptions:

• The Faculty’s performances are categorized in five categories depending on their performance as Exceptionally Good, Superior, Successful, Satisfactory and Needs Improvement.

• The scores of the Questionnaires are categorized in five parts as Best, Very Good, Good, Satisfactory and Poor.

• These scores are categorized depending on the no. of questions answered ‘Yes’. If # ‘Yes’ > 20, then Best, If # ‘Yes’ >15, then Very Good and so on.

• Again the No. of Years of Experience of faculty is Categorized in five categories; >10 yrs., >8 yrs., > 6 yrs. >4yrs., >2 yrs.

[6] COMBINING FORMATIVE AND SUMMATIVE EVALUATION WITH OTHER FOR OVERALL EVALUATION

After finding the results of both formative and summative assessment, one need to take into consideration the assessment/appraisal of a faculty by their immediate senior and management personnel for overall assessment. We propose to do this by means of multiple assessment parameters. These assessment parameters are organized into broad heads, and have been further elaborated through suitable sub-heads. Each broad head has an overall weight assigned to it. Within each head, the sub-heads also have an appropriate weight distribution. A suitable metric is then proposed, based on this data, which computes a score under each sub-head. The sub-head scores are then added to obtain scores for each individual head. The overall score is computed based on the weights allotted to each head. The overall score can take a maximum value of 100. Ranking/grading can be done based on the scores of faculties, then Department and further at institutional level.

Depending on the scores of all the faculty in a Department, the overall departmental score can be calculated, again depending on the various departmental scores either one department can be compared with another or an individual Institute can be compared with another.

Since the teaching Faculties are at the helm whenever any institute is graded among its peer, they are the driving force whose efforts create competitive and technically sound students who need to face the Global competition for career advancement on completion of their college studies, it is imperative that institutes need to pay serious attention on the up gradation of faculties for up gradation of themselves among peer institutes.

A study of different accrediting bodies in India and world signifies that more emphasis has been made by different grading bodies in India and world for hiring and sustaining capable and efficient staff for institutional betterment. So it has become prime duty of any institute not only to evaluate and assess the performance of existing faculty but also encourage and inspire them for their professional development, which in the long run will definitely benefit the institute as well.

Performance evaluation of any institute is one among the prime factors related to institutional and organizational development. Using this research, the Institutional superiors will have the ability to predict not only the departmental and employee’s performance but also they will come to know where their organization stands among its peer. The parameters discussed helps to analyze the performance of any educational institute in multiple ways, and help to get

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most efficient results for upgradation of an organization. Unless and until, the institutes in which the students are studying will be upgraded and loopholes overcomes, students will not be able to benefit most from the institute. The framework proposed helps to evaluate faculty in any institute in a speedy way, with maximum parameters of its performance included for most efficient results. If we are including more parameters, it means the evaluation will be more effective, and the results will be more realistic based on factual information.

Evaluation of performance is a process of quality assurance and improvement, whereby a program in an approved institute is critically appraised to verify that the Institution or the program continues to meet and exceed the Norms and Standards prescribed. It does not seek to replace the system of award of degree and diplomas by the Universities/autonomous Institutions, but, provides quality assurance that the academic aims and objectives of the Institution are honestly pursued and effectively achieved by the resources currently available, and that the Institution has demonstrated capabilities of ensuring effectiveness of the educational programs. Since the teaching staffs are of the foremost important factors on which its performance is dependent, so our work tries to improve and analyze teacher performance through the study of their specialization and expertise. It also suggests measures which can assist them in improving their performance further; so as to make them an asset not liability in the institution they seek employment. By offering précised directed courses to the teacher according to their qualification and experience, the proposed system intends to improve their grades, thereby upgrading the institute they are associated with.

[7] CONCLUSION AND FUTURE WORK

Educational Institute like any other organization are challenged to stay relevant—both in terms of education and research. A review of the Financial Times, The Economist or any magazine that covers Educational Institute leads one to conclude that institutes are under constant assault by industry, journalists and academics alike to justify their existence, relevancy and effectiveness, given the rapid rate of change in today’s world. With today’s dynamic and highly competitive environment, the organizations tend to lose their competitiveness/business, if their employees, resources and technology don't keep pace with the emerging technologies. The transformation from production economy to knowledge economy has provided both the opportunities and challenges. This scenario is true in underdeveloped and developing countries. The organizations require man power with different set of values and competencies which should be productive, creative, responsive and adaptable to fast changing business environment. So, it becomes impetus to understand the knowledge in the Human Resource (HR) data. In today’s fast changing business environment the role of IT is changing a lot. Its use has not been restricted to record keeping, processing transactions or viewing the reports and analysis of data but the role has been extended to take decisions and to build strategies for enhancing the business usage from Management Information System (MIS) to the Decision Support System (DSS). The DSS helped the managers to extract the critical information from their huge data in the way they want.
REFERENCES


