

Faculty Performance Evaluation Using Data Mining

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Abstract

Assessment as a dynamic process produces data, which acts as performance indicator for an individual and subsequently impacts on the decision making of the stakeholders as well as individual. The idea proposed in this system is to perform an analysis considering number of parameters for the derivation of performance prediction indicators needed for faculty performance assessment, monitoring and 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 faculty motivation, satisfaction, growth and decline. The analysis depends on many factors, encompassing student's feedback, organizational feedback, institutional support in terms of finance, administration, research activity etc. The data mining methodology used for extracting useful patterns from the institutional database is able to extract certain unidentified trends in faculty performance when assessed across several parameters.

Keywords

Data Mining, K Means Clustering, Apriori Association Rule, Performance Evaluation

I. Introduction

Performance Evaluation (PE) is a systematic and periodic process that assesses an individual employee's job performance and productivity in relation to certain pre-established criteria and organizational objectives and also aspects of individual employees are considered as well, such as organizational citizenship behavior, accomplishments, potential for future improvement, strengths and weaknesses, etc. To collect PE data, there are three main methods: objective production, personnel, and judgmental evaluation. Judgmental evaluations are the most commonly used with a large variety of evaluation methods. A PE is typically conducted annually. The interview could function as "providing feedback to employees, counseling and developing employees, and conveying and discussing compensation, job status, or disciplinary decisions". PE is often included in performance management systems. Performance management systems are employed "to manage and align" all of an organization's resources in order to achieve highest possible performance. "How performance is managed in an organization determines to a large extent the success or failure of the organization. Therefore, improving PE for everyone should be among the highest priorities of contemporary organizations".

Potential benefits include:

- Facilitation of communication
- Enhancement of employee focus through promoting trust
- Goal setting and desired performance reinforcement
- Performance improvement
- Determination of training needs

PE in teaching at the university level would include measures such as student feedback that consists of several questions, for example: What were the most helpful courses? What was least beneficial? What do you need more of? Teaching does not only include learning outcomes, but the overall quality of pedagogy. The possible approaches to teaching and learning should be established with keeping in mind the desired outcomes. Quality of performance in teaching requires that the higher educational institutions prepare students for their first position as well as provide the basis for performance in future positions. Quality of teaching depends on the qualifications and research potential of the academic staff. The fundamental challenge in university decision-making is the requirement to institutionalize the values of academic professionals, values that typically resist the very processes of institutionalization. From the other hand to be

effective and to do their best work, academic professionals require substantial autonomy. Research outputs, as well as successful teaching, are expected of all faculties, and are used as a basis for promotion and continuing appointment. This is also important for the future success of a university, as it helps to attract students of different levels. Data mining (the analysis step of the "Knowledge Discovery in Databases" process, or KDD), is a field at the intersection of computer science and statistics, is the process that attempts to discover patterns in large data sets. It utilizes methods at the intersection of artificial intelligence, machine learning, statistics, and database systems. The overall goal of the data mining process is to extract information from a data set and transform it into an understandable structure for further use. Aside from the raw analysis step, it involves database and data management aspects, data preprocessing, model and inference considerations, interestingness metrics, complexity considerations, post-processing of discovered structures, visualization, and online updating. The actual data mining task is the automatic or semi-automatic analysis of large quantities of data to extract previously unknown interesting patterns such as groups of data records (cluster analysis), unusual records (anomaly detection) and dependencies (association rule mining). This usually involves using database techniques such as spatial indexes. These patterns can then be seen as a kind of summary of the input data, and may be used in further analysis or, for example, in machine learning and predictive analytics. For example, the data mining step might identify multiple groups in the data, which can then be used to obtain more accurate prediction results by a decision support system.

A. Present Scenario

In traditional method, in any institution, the only way to evaluate a faculty is by taking feedback from students, which is not correct. There are factors concerned to faculty which can be used to evaluate them. Taking into account the other parameters of faculty to evaluate them would be better to improve the quality of teaching, in turn the performance of the institute. Parameters of faculty such as student's performance, student feedback and other activities like papers presented, workshops, seminars and conferences attended and conducted etc. can also be considered to evaluate a faculty.

B. Objectives

- Exploring different Data Selection methods such as in record form.
- Exploring different clustering techniques such as K means for different parameters of faculty.
- Exploring frequent itemset generation for Apriori algorithm for Association rule.

In overall, developing algorithmic models for Faculty Performance Evaluation System.

C. System Architecture

In the proposed system, the data related to all faculty members is being stored in a database. The performance of any faculty or group of faculty members is being displayed in graphical form, so that the management can easily take decisions on any of the parameters related to faculty.

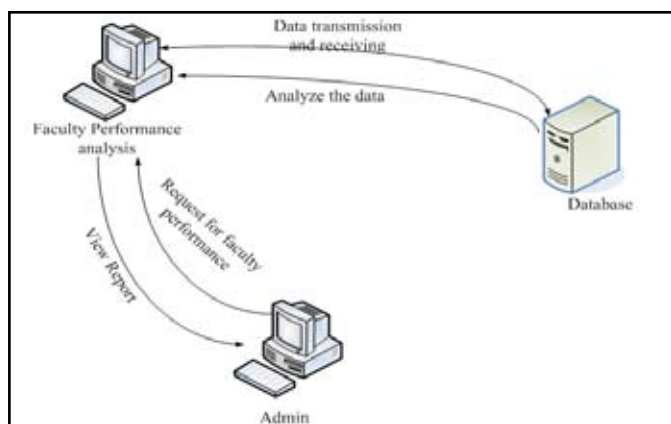


Fig. 1:1

II. Related Work

The main objective of higher education institutions is to provide quality education to its students. One way to achieve highest level of quality in higher education system is by discovering knowledge for prediction regarding enrolment of students in a particular course, alienation of traditional classroom teaching model, detection of unfair means used in online examination, detection of abnormal values in the result sheets of the students, prediction about students’ performance and so on. The knowledge is hidden among the educational data set and it is extractable through data mining techniques[1]. Undoubtedly, performance appraisal is one of the most important responsibilities for the organizations. On one hand, it is an important source of information for executives to make decisions such as: granting pay, improving employee’s work performance, selecting or assigning or terminating employees, identifying employees with potential for advancement, and planning for future human resources needs. On the other hand, it contributes to gain the competitive advantages of the organization[2]. The performance appraisal is dealing with people: judging people, motivating people and cultivating people, as is the basis of core competency of the organization. It can distinguish the top performers from the mediocrities and help to achieve the motivational effect by rewarding the former reasonably. It helps the employee to master the job skill. As “working smarter” becomes increasingly vital nowadays, effective performance appraisal helps employees identify areas for improvement in work, as well as helping proficient performers reach even [3].

Graded Point Average (GPA) is a commonly used indicator of academic performance. Many Universities set a minimum GPA that

should be maintained in order to continue in the degree program. In some University, the minimum GPA requirement set for the students is 1.5. Nonetheless, for any graduate program, a GPA of 3.0 and above is considered an indicator of good academic performance. Therefore, GPA still remains the most common factor used by the academic planners to evaluate progression in an academic environment. Many factors could act as barriers to students attaining and maintaining a high GPA that reflects their overall academic performance during their tenure in University. These factors could be targeted by the faculty members in developing strategies to improve student learning and improve their academic performance by way of monitoring the progression of their performance[4]. Data mining is considered as the most suitable technology in giving additional insight into educational entities such as; student, lecturer, staff, alumni and managerial behavior. It acts as an active automated assistant in helping them to make better decisions on their educational activities. The final result is improved decision making processes in higher learning institutions. This improvement would carry the following advantages including; increasing student’s promotion rate, retention rate, transition rate, increasing educational improvement ratio, increasing student’s success, increasing student’s learning outcome, maximizing educational system efficiency, decreasing student’s drop-out rate, and reducing the cost of system processes. Following covers, data mining applications in learning institutions[5].

III. Materials & Methods:

Different parameters used to evaluate a faculty can be such as seminars, workshops, conferences conducted or attended, paper presented and even other activities such as event conducted (quizzes) etc. Taking into account the above parameters, tables are created for faculty and each parameter with sub parameter as follows.

Table 1: Faculty details

Facid	Fac Name	Degree	Experience
1	Vani	BE	3
2	Nirmala	BE	5
3	Leela	PhD	15
4	Sunitha	PhD	25
5	Nirmala so	MTech	20
6	Geetha	MTech	15
7	Rama	PhD	32
8	Ravi	BE	8
9	Anupama	BE	4
10	Banupriya	MTech	7
11	Roopa	BE	4
12	Radha Krishna	MTech	8

Table 2: Feedback details

Fac Name	Question	Feedback	Student
Vani	3.Real Time Examples	3	Bhaskar
Leela	2. Covering of Syllabus	3	Devraj
Vani	1.Use of Black Board	3	Manu
Nirmala	1.Use of Black Board	2	Raghu

Rama	1.Use of Black Board	4	Ravi
Nirmala SO	2. Covering of Syllabus	4	Ravikanth
Sunitha	2. Covering of Syllabus	4	Tanu
Rama	3.Real Time Examples	3	Tanvi

Table 3: Pass Percentage

Fac Name	Subject Name	Pass Percent
Banupriya	HDL	85
Leela	DSP	78
Nirmala SO	OS	79
Rama	C++	81
Ravi	AEC	65
Roopa	NA	78
Sunitha	Java	68
Vani	OS	80

Table 4: Parameters

Parameter
Conference
Event
Paper Presentation
Seminar
Workshop

Table 5: Sub Parameters

Parameter	Sub Parameter	Value
Conference	International	9
Conference	National	6
Event	E Quiz	4
Paper Presentation	National	6
Work Shop	International	9
Work Shop	National	6

Table 6: Assign Parameter

Fac Name	Parameter	Sub Parameter	Value
Vani	Event	E Quiz	8
Vani	Paper Presenta- tion	National	5
Vani	Paper Presenta- tion	International	10
Leela	Workshop	International	9
Nirmala S O	Workshop	National	6
Nirmala S O	Event	Quiz	4
Sunitha	Conference	International	9

The following data mining algorithms are being used.

A. K-Means Algorithm:

Iterative, hard, flat clustering algorithm based on Euclidean distance.

- Specify k the number of clusters to be generated.
- Choose k points at random as cluster centers.
- Assign each instance to its closest cluster center using Euclidean distance
- Calculate the centroid (mean), for each cluster, use it as a new cluster center.
- Reassign all instances to the closest cluster center.
- Iterate until the cluster center do not change any more.

B. Apriori Algorithm for Association Rule

Input: D : database over the set of items j ,

Output: F : the set of frequent itemsets

1. $k = 1; C_k = j$
2. while $C_k \neq 0$ do
3. support_count(D, C_k)
4. forall candidates $c \in C_k$ do
5. if $c.support \geq minsup$ then
6. $F_k = c$
7. endif
8. endfor
9. $C_{k+1} = candidate_generation(F_k)$
10. $k = k + 1$
11. endwhile
12. $F = \bigcup_{j=1}^k F_j$

With the above tables and the two algorithms, the following results are observed.

IV. Results & Snapshots

With the above database by applying K means Clustering algorithm, taking two parameters at a time, the following output in X-Y graph and Pie chart can be seen.

V. Conclusion

In overall, institute as a whole can perform better by improving its faculty.

By applying data mining algorithm of K means Clustering, the institute administration will be able to make groups of faculty members with different parameters for future use. Thus helps in comparison also, in turn in decision making.

By applying data mining algorithm of Apriori Association rule, the administration will be able to decide on who all faculty members with different parameters are supporting with minimum value for a particular activity. Thus helps in decision making in conducting workshops, seminars or conferences etc.

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