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Enhancing Educational Quality: A Prototype System for Evaluating Faculty Performance in Higher Education

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Abstract— Ensuring educational quality in higher education is a global concern transcending borders, including India. Nations worldwide recognize the significance of teaching faculties in enhancing their educational institutions' prestige. Consequently, there is a growing emphasis on retaining and motivating faculty members to elevate their institutions to world-class standards. This necessitates the periodic evaluation of faculty performance to gauge the overall educational institute's effectiveness. Continual monitoring of institute quality and the teaching-learning process is imperative for sustaining educational standards. In essence, the responsibility lies with teaching faculties nationwide to impart the right skills and knowledge to students. Expert guidance and constructive feedback from mentors are pivotal in students' skill development and knowledge enrichment. Students greatly value faculty members who support and inspire them throughout their arduous academic journeys. This research paper introduces a prototype system designed to assess, evaluate, and provide recommendations for faculty performance within educational institutions. The proposed system aims to contribute to the ongoing efforts to enhance educational quality and faculty effectiveness.

Keywords— Educational Quality, Faculty Performance, Higher Education, Teaching Faculties, Evaluation System.

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1. Introduction

Education is a cornerstone in developing and empowering a nation's human resources, fostering progress and prosperity at various stages of its evolution. Within the educational landscape, higher education, encompassing fields such as Engineering, Medicine, Sciences, and Arts, assumes a pivotal role. It serves as a conduit for knowledge dissemination, values inculcation, and skill development among the youth, whose competencies significantly contribute to a nation's growth and productivity (Lazić Z. et. al. 2021). Ensuring the uncompromised quality of education within institutions becomes imperative. This guarantees that graduates are equipped to compete effectively on a global scale, armed with the requisite knowledge and skills (Mohamed, M. H., & Waguih, H. M. 2018) (Job, M. A. 2018). The keystone of educational success lies in the competence of teaching faculties. Mere possession of knowledge and academic qualifications does not guarantee the

qualities of an effective teacher. To excel, educators must possess a profound understanding of human behavior, its evolving needs, and developmental principles, in light of dynamic forces such as urbanization, technological advancements, and industrialization. Professionalism, both within and beyond the classroom, is paramount for teachers (Irawan, A. P. et.al. 2021) Institutions must employ precise methods to assess faculty performance, aligning their objectives with institutional goals. Assessment and accreditation processes empower higher education institutions to ascend the ladder of quality, fostering the internalization of quality attainment, maintenance, and sustainability (Agrawal R. et. al. 2020). Furthermore, it is imperative to identify and bridge the gap between the anticipated proficiencies and the actual proficiencies of faculty members, highlighting areas where improvement and growth are essential. The Importance of Education for National Prosperity and Human Resources Development can't be denied at any stage of human life (Hartanto, B. (2015). A country's people resources are developed and empowered via education, which serves as the cornerstone for the progress and prosperity of the nation. Within the vast educational landscape, higher education, spanning fields like Engineering, Medicine, Sciences, and Arts, assumes an indispensable role. It functions as the conduit through which knowledge is disseminated, values are instilled, and the youth's skills are honed, thus making their competencies a substantial driving force behind a nation's growth and productivity (Sharma, S. C., & Inda, S. S. 2021). The paramount importance of safeguarding the unimpaired quality of education within educational institutions cannot be overstated. This commitment ensures that graduates are well-prepared to compete on a global scale and equipped with the essential knowledge and skills demanded by a constantly evolving world (Mabić, M., et. al.2017) (Bhambri, V. 2016). At the heart of educational success lies the competence of teaching faculties. It is essential to recognize that mere possession of knowledge and academic qualifications does not guarantee the qualities of an effective teacher. Faithful excellence in education requires educators to understand human behavior, its evolving needs, and the foundational principles of human development while adapting to the challenges posed by dynamic forces such as urbanization, technological advancements, and industrialization. Both inside and outside the classroom, professionalism emerges as a cornerstone of effective teaching (Kumar, P. et. al. 2020). Institutions considered with imparting higher education must employ precise methodologies to assess and evaluate faculty performance. This evaluation process should closely align with the primary objectives and institutional goals. Robust assessment and accreditation procedures empower higher education to improve educational quality, fostering the internalization of quality attainment, its maintenance over time, and its long-term sustainability (Clark, A. K., & Karvonen, M. 2020).

Furthermore, it is not just essential but imperative to recognize and address the gap between the anticipated proficiencies of faculty members and their actual competencies. Identifying these discrepancies sheds light on areas where improvement and growth are urgently needed. Through this self-reflective and adaptive approach, higher education institutions can continue to thrive and fulfill their mission of nurturing the next generation of leaders and innovators in an ever-evolving global landscape (Zain, J. M., & Herawan, T. 2014). The rest of the paper is organized as follows. Section 2 covers the proposed framework for the institute, including discrete methods for overall faculty assessment. Based on multiple parameters. Section 3 covers the steps and the methodology of the department's post-assessment of faculty. Section 4 focuses on the results obtained and their discussion. Finally, section 5 concludes the manuscript including limitations and future scope.

2. Proposed Framework For Performance Assessment

Performance appraisal, a constructive process for evaluating educational institutions and their employees, necessitates clear, achievable goals. This proposed study employs a design-based research methodology for its structured yet adaptable nature. It seeks to enhance educational practices through iterative analysis, prototype development, and real-world implementation, drawing input from researchers and professionals to refine and optimize educational processes (Baby A. M. 2018,).Multi-Source Feedback: Incorporating feedback from various sources such as students, peers, and administrative staff ensures a balanced perspective. This reduces the risk of a single viewpoint dominating the evaluation, leading to a more fair and accurate assessment. The proposed assessment framework is meticulously designed to collect data from credible sources that offer substantial insights. It encompasses various dimensions of faculty performance evaluation, each drawing data from diverse channels.

These assessment parameters encompass faculty performance in academics, which relies on feedback from undergraduates under their auspices. Another critical facet involves evaluating an individual's involvement in research and professional activities, their commitment to quality enhancement, and their self-evaluation as academic facilitators. Additionally, the appraisal incorporates the faculty's rating by the educational institution's management.

The initial performance indicator involves soliciting feedback on faculty academic performance from undergraduate students mentored by faculty members. This step requires careful consideration of students' attendance and academic performance since scholars who attend classes regularly and excel academically can provide more meaningful assessments of teaching faculty. Hence, factors like attendance, academic performance, and continuous assessment, including internal examinations, are considered before collecting feedback from students.

Several attributes are considered to gauge undergraduate assessment skills accurately, including student attendance in lectures and laboratory sessions, grades achieved in assigned coursework, and performance in continuous assessment and internal examinations. Furthermore, results from previous semester-end examinations are integrated into the evaluation process to provide a comprehensive perspective on faculty performance.

Faculty Assessment On Multiple Parameters

The initial evaluation parameter for teaching faculty primarily focuses on student feedback. as mentioned in the following subsection.

Faculty Formative Evaluation Based on Student Input

Assessing a teaching faculty's academic competence primarily relies on classroom performance, with data drawn from key stakeholders, namely the students (Agrawal R, et. al. 2017). A formative assessment form comprising 25 questions to assess academic qualities was crafted and distributed to students, as depicted in Table 1.

Students were mailed a link to access the Faculty Formative Assessment form for online submission. The link consists of a questionnaire including the questions mentioned in Table 1. It is essential to address the gaps in faculty feedback data where students have not provided information. These gaps need to be filled with the most feasible and accurate values. Additionally, the text-based information collected from students is transformed into numerical data, which must then be organized categorically by branch, faculty, and subject. Once all questionnaire responses have been gathered, the data collection process for formative feedback is completed. Table 2 presents the dataset after converting textual information into numerical values, representing the initial stage of data pre-processing. Data mining with

Table 1:
Questions for Faculty Assessment by Students [14]

Attributes	Attributes Description	Possible Values
Teacher ID	Unique ID of Each Faculty	To be responded by Each Student
Name	Faculty Name	
Branch	Select From the Different Branches	
Semester	Year and Semester of student giving feedback	
Subject	Subject taught by concerned Faculty	
F1-PL	Lecture Presentation Faculty	{1,2,3,4,5}
F2-CS	Communication Skills of Faculty	{1,2,3,4,5}
F3-CD	Delivery of Content by Faculty	{1,2,3,4,5}
F4-EP	Explanation Power of Faculty	{1,2,3,4,5}
F5-SK	Subject Knowledge Possessed by Faculty	{1,2,3,4,5}
F6-PLN	Prepares and Updates Lecture notes of all Topics	{1,2,3,4,5}
F7-DC	Faculty Clears Doubts of Students	{1,2,3,4,5}
F8-ESL	Encourages Students in learning	{1,2,3,4,5}
F9-GKL	Gained Knowledge from Lectures	{1,2,3,4,5}
F10-AR	Regularity in Assignment	{1,2,3,4,5}
F11-OCS	Percentage of Syllabus Completed	{1,2,3,4,5}
F12-SIAJ	Justified approach towards Internal assessment justified- SIAJ	{1,2,3,4,5}
F13-PD	Discussion of Topic related Problems	{1=Yes;0=No}
F14-RPL	Revision of Previous Lectures	{1=Yes;0=No}
F15-EPE	Faculty Explains with Practical Examples	{1=Yes;0=No}
F16-SPP	Solved Previous year Paper	{1=Yes;0=No}
F17-EA	Faculty Evaluates Assignments given to students	{1=Yes;0=No}
F18-DAQ	Discussion of Assignment Questions	{1=Yes;0=No}
F19-SFFD	Students feel free to contact faculty to ask Doubts	{1=Yes;0=No}
F20-FA	Friendly Attitude	{1=Yes;0=No}
F21-PSC	Problem Solving on Chapter Completion	{1=Yes;0=No}
F22-CTP	Faculty Correlates Theory with Practical	{1=Yes;0=No}
F23-ITLM	Innovative Teaching –Learning methods Used	{1=Yes;0=No}
F24-STHS	Faculty should teach in higher semester	{1=Yes;0=No}
F25-OES	Overall Evaluation of Faculty	{1,2,3,4,5}

many attributes increases the system complexity, so it is advisable to combine similar-looking attributes to reduce system complexity (Jones K. et. al. , 2020). Working with the same thought, we combined attributes with similar characteristics. So, from the overall 25 attributes that were considered for faculty academic performance assessment, they were reduced to 5.

Faculty's Summative Assessment reflecting Research and professional Traits of a Faculty

Performance assessment is an accepted appraisal system agreed upon between employees and management personnel. Appraisal aims to evaluate employees' strengths regularly and assess efforts needed in the discrete areas to enhance the performance of the teaching faculty and thus attain the best possible quality (Guo P. et. Al. ,2020). Summative evaluation is required to determine faculty contributions to research, self-improvement, and other professional activities associated with examinations and the organization's growth. First, an inspection of the needs is conducted. For this, classification of summative assessment into certain broad categories was done, such as faculty contribution in departmental work, faculty involvement in institutional work or university examinations, etc. For this, information was also collected from academic faculties of discrete departments teaching

Different courses, basically from engineering, to find out their involvement and contribution in departmental and institutional happenings; a form is again designed in 'Wufoo' for this purpose of assessment. The form link is shared with the departmental faculties, and the responses received from the corresponding faculties are noted. As with the formative assessment, the information is collected from individual faculty members for their summative assessment. We have gathered information from 51 faculty members working in 6 engineering departments for the current research work. The departments included in our work are Computer Science, Information Technology, Electrical, Electronics, Mechanical and Metallurgy. Again, as the attributes involved are too high, so we combined similar attributes to ease data mining. The assessment encompasses three attributes: University Examination Involvement (IUE), Departmental Work Involvement (IDW), and Project Guidance Involvement (IPG). Summative Assessment consists of 25 questions, grouped into five sections: IRA, IPD, IUE, IDW, and IPG.

Cumulative Assessment by Combining Management Grades with Summative and Formative Assessment

To comprehensively assess the performance of teaching faculty within a specific department of an institute, it is imperative to establish discrete assessment parameters. Beyond evaluating academic qualities through student feedback and self-assessment by faculty, feedback from the institute's management is also considered (Slade S. et.al. 2019).The complete score is determined based on assigned weights for each assessment parameter. An analysis of data collected for the 50 faculties has revealed interesting insights:

a) In some cases, senior faculty members actively contribute to research and professional bodies, proving to be assets to their parent organization. However, they may not exhibit the same enthusiasm or involvement in classroom lectures for their assigned courses.

b) Conversely, some young and passionate faculty members excel at mentoring students but may not prioritize professional advancement, mainly if they are relatively new to academia.

c) There are also faculty members who strike a balance between their academic and research goals, earning recognition for their dedication to both aspects.

Considering these factors and practical constraints, assigning appropriate weightage to each assessment factor is essential for faculty, department, and institute grading. The questionnaires for formative and summative assessments allocate scores of 75 and 25, respectively. To balance the assessment scores and reduce potential biases, the summative and management scores are multiplied by 5. Thus, formative assessment contributes 75 points, summative assessment 125 points, and management assessment 25 points, resulting in a total score of 225. Faculty members fall into different grades based on their total scores. A score between 226 and 250 earns an A+ grade, while a score between 201 and 225 leads to an A Grade. Final grades are determined by combining all appraisal scores, simplifying the grading process.

Table 2:
Portion of Data Set Collected for Faculty Evaluation [15].

Entry Id	Roll Number	Sem	Branch	Name of Faculty	Last Name	Subject	PL	CS	CD	EP	SK	PLN	DC	ESL	GKL	AR	OCS	AIAJ	OES	PD	RPL	EPE	SPYP	EA	DAQ	SFFD	FA	PSC	CTP	ITLM	STHS	Date Created	Created By	Last Updated	Updated By	IP Address	Last Page Accessed	Completion Status
33	567	5	IT	Bhakti	Patil	Computer Network	5	4	4	4	5	4	4	5	4	4	4	4	5	1	1	1	1	0	1	1	1	0	1	0	1	17-12-25 18:16:58	public	18-01-11 12:02:23	public	110.224.209.232	1	0
34	5	5	IT	Bhakti	Patil	Computer Network	4	3	4	4	5	3	4	5	3	4	4	3	4	1	1	1		0	0	1	1	1	0	0	1	17-12-25 18:19:15	public	18-01-11 12:03:29	public	49.35.9.191	1	0
35	6	5	IT	Bhakti	Patil	Computer Network	4	5	4	5	5	5	4	4	5	5	5	5	5	1	1	1	1	0	1	1	1	0	1	1	1	17-12-25 18:20:27	public	17-12-25 18:21:59	public	49.35.9.191	2	1
36	0	6	IT	Nilesh	Patil	Computer Graphics &VR	4	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1	1	1	1	1	1	1	1	17-12-25 19:17:45	public	17-12-25 19:18:49	public	42.109.55.245	2	1
37	764	7	IT	Nilesh	Patil	Cloud Computing	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1	1	1	1	1	1	1	1	17-12-25 20:45:01	public	17-12-25 20:45:14	public	59.182.190.173	2	1
38	769	7	IT	Nilesh	Patil	Cloud Computing	4	5	5	5	5	4	5	5	4	5	5	5	5	1	1	1	0	1	1	1	1	1	1	1	1	17-12-26 07:22:47	public	17-12-26 07:24:03	public	27.106.12.66	2	1
39	707	7	IT	Shirish	Sabnis	Intelligent System	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1	1	1	1	1	1	1	1	17-12-26 07:51:53	public	17-12-26 07:53:29	public	115.96.210.249	2	1
40	2	5	CSE	Varsha	Shrivastava	Operating System	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1	1	1	1	1	1	1	1	17-12-26 09:36:56	public	17-12-26 09:37:15	public	27.106.11.24	2	1
41	16	7	CSE	Rupesh	Mishra	Mobile computing	4	3	2	2	3	3	4	3	2	4	4	3	2	1	1	1	0	1	1	1	1	1	1	0	0	17-12-26 09:37:29	public	17-12-26 09:39:25	public	203.115.64.156	2	1
42	59	5	IT	Shubham	Lad	Data Structures	4	4	4	3	4	4	4	4	3	3	3	3	4	1	1	1	1	0	0	1	1	1	1	1	1	17-12-26 09:39:44	public	18-01-11 11:58:10	public	49.35.255.91	1	0
43	11	5	IT			Operating System	4	4	4	5	5	5	4	4	4	5	4	4	5	1	1	0	1	0	0	1	1	1	0	1	1	17-12-26 09:42:10	public	17-12-27 11:50:37	public	43.224.164.180	1	0
44	40	7	CSE	Reeves	Gonsalves	Robotics and AI	5	5	5	5	5	5	5	5	5	5	5	5	5	1	1	1	1	1	1	1	1	1	1	0	1	17-12-26 09:56:13	public	17-12-26 09:57:45	public	27.0.52.108	2	1
45	41	7	CSE	Safa	Hamdare	Robotics and AI	5	5	5	5	4	5	5	4	5	5	4	5	4	1	1	1	1	1	1	1	1	1	1	1	1	17-12-26 10:07:23	public	17-12-26 10:09:17	public	45.112.13.84	2	1
46	567	5	IT	Shubham	Lad	Data Structures	4	3	3	4	3	2	3	3	3	4		3	3	1	1	0	0	0	0	1	1	0	1		0	17-12-26 10:07:48	public	18-01-11 11:56:00	public	171.77.131.45	1	0
47	0	7	E Tc	Santosh	Chapaneri	Mobile Communication	4	4	3	3	3	4	3	3	2	3	3	2	3	0	0	0	1	1	1	0	1	0	1	0	0	17-12-26 10:17:53	public	18-01-11 11:52:18	public	223.196.88.239	2	1
48	48	5	E Tc	Santosh	Chapaneri	Mobile Communication	5	4	4	5	5	5	5	4	2	3	3	3	5	1	1	1	1	0	0	1	1	1	1	0	0	17-12-26 11:39:52	public	18-01-11 11:53:04	public	139.167.109.236	2	1
49	51	3	CSE	Jayashree	Mittal	Data Structures	5	5	5	5	5	5	5	5	5	4	4	4	5	1	1	1	1	0	0	1	1	1	0	1	1	17-12-26 11:50:44	public	18-01-15 12:10:45	public	94.129.172.42	2	1
50	43	3	CSE	Jayashree	Mittal	Data Structures	4	4	4	3	3	3	4	4	3	4	3	4	4	1	1	1	1	0	0	1	1	1	0	0	1	17-12-26 12:03:22	public	18-01-15 12:09:20	public	182.59.175.103	1	1
51	41	5	CSE			Computer Network	4	3	3	4	4		4	4	4	4	4	4	4	1	1	1	1	0	0	1	1	1	0	1	1	17-12-26 12:31:19	public	17-12-27 11:42:32	public	27.0.52.123	1	0
52	17	5	IT			Operating System	4	4	3	4	4	4	4	3	3	4	4	3	4	1	1	0	0	1	1	1	1	1	0	0	1	17-12-26 13:43:51	public	17-12-27 11:31:59	public	223.184.28.8	1	0

It's important to note that some educational data may have missing attributes, which could be insignificant or contain confidential information. For instance, students may be unwilling to disclose their mentor's identity or hesitate to share their own information while rating their faculty. Before mining such datasets, ensuring completeness and consistency as much as possible is crucial in cases where missing features and appropriate values should be substituted to maintain data integrity. In our study, we addressed students' and institutions' reluctance to reveal sensitive information by assigning unique codes to faculty members associated with the institute. This alphanumeric code, derived from the department and faculty ID, is a primary key for faculty identification.

3. Methodology For Grading A Department

After assessing the teaching faculty's performance, the results are employed to evaluate the department to which the faculty member belongs. This assessment relies on the combined scores from formative assessments, summative evaluations, and managerial appraisals. Data collected from students and individual faculty members within the department must be reorganized according to their respective departments before the departmental evaluation process. To maintain clarity and precision, distinct codes or IDs have been assigned to differentiate between various departments, as is clear from Table 3. It is assumed that the assessed faculties exclusively contribute to the teaching responsibilities within their respective departments, ensuring a clear demarcation of roles and responsibilities.

Table 3 :
Calculation of Departmental Grades [15]

Deptt_ID	*S_FA*	*G_FA*	*S_SA*	*G_SA*	*Mgmt_S*	*Mgmt_G*	*DepttScore*
Mech	43	6	90	16	6	6	B+
Mech	48	8	105	20	8	8	A-
Mech	35	6	105	20	5	8	A-
Mech	47	8	100	20	8	8	A-
Mech	48	8	80	16	7	8	B+
Mech	38	8	75	12	4	6	B
Mech	42	6	100	20	6	8	A-
Mech	55	8	105	20	7	10	A
Met	20	2	85	16	3	2	B
Met	43	6	95	16	5	6	A-
Met	38	6	110	20	7	8	A-
Met	54	8	90	16	7	8	A-
Met	47	8	95	16	7	8	A-
Met	35	6	95	16	5	6	B+

Table 3 showcases a subset of the comprehensive data collected from seven departments: Computer Science and Engineering, Electrical Engineering, Information Technology, Mechanical Engineering, Metallurgical Engineering, Electronics Engineering, and Electronics and Telecommunication. However, the data gathered from the latter two departments lacked sufficient detail for effective data mining. To address this, we amalgamated these two departments, treating them as a single entity for research purposes. The data for each department was meticulously arranged after organizing the dataset specific to each faculty member within a department and computing their scores and grades. A unique code was assigned to each department for clarity and evaluation purposes. The attributes used for department evaluation include S_FA (scores from formative assessment by faculty), G_FA (grades from the formative assessment of faculty), S_SA (scores from summative assessment), Mgmt_G (management assessment grades), Mgmt_S (management assessment scores), and Deptt_ID (department identification code). The data in tabular form presented here represents only a fraction of the extensive data set analyzed for departmental evaluations. The dataset comprises information from the individual departments under evaluation. The size of this dataset varies across departments due to the varying number of faculty members in each. In contrast, the training dataset encompasses the entire data collected from all departments.

This approach allows for a comprehensive assessment of faculty and departmental performance, enabling us to draw meaningful insights and make informed decisions based on the collected data. The next step involves the Generation of a Decision Tree for Departmental Assessment, as shown in Fig.1. An explanation of the Decision tree obtained from our work can be interpreted as Among the 51 faculties assessed in 6 departments.

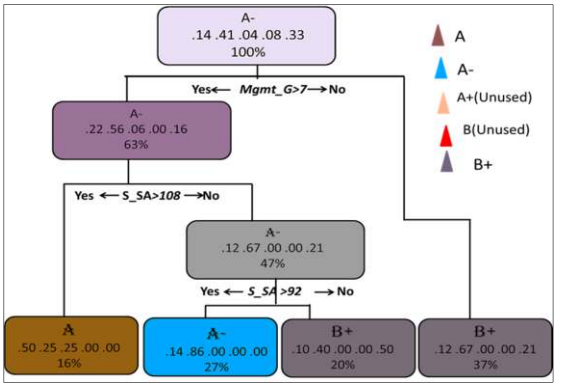

Fig. 1 : Decision Tree for Departmental Assessment.

- IF MGMT_G > 7, THEN TWO CASES ARISE

32 faculties satisfy this condition, then we need to check another condition

o Whether S_SA Grade > 108

(Check only for those faculties with Mgmt_G > 7 whether their Summative Assessment score is greater than 108)

Only 8 faculties satisfy these criteria and are graded as 'A' as shown in Fig. 1. Similarly, moving in the same pattern, we can classify all the faculties in a department. Further, with the aid of the decision tree obtained, we can also interpret the department.

4. Observations And Analysis Of Results

4.1 Analysis of the Department's Academic Faculty

The aforementioned methodology is applied to the compiled data for unit evaluation. Departmental grades can be determined by applying a suitable formula to the individual faculty members' grades. The faculties of each department can be analyzed. An analysis of six departments and its faculty has been presented in Fg-2. From this figure, it's quite easy to categorize the department and its respective faculty if a need arises for a comparison of different departments in an educational institute. The data gathered from 51 faculty that received grades of C. D cannot be utilized because the percentage of faculty scoring these grades is lower than 10%, as demonstrated by the pie chart shown in Fig.3. Therefore, if a decision tree is constructed using the collected data, it will only contain the grades of A, A-, and B+. In the same way, all of the grades of all of the faculty in a department can be looked at.

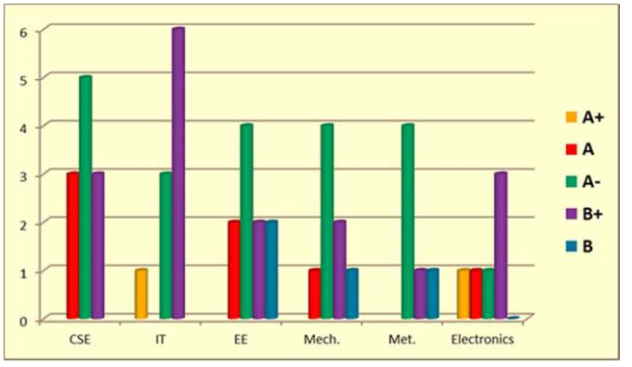

Fig. 2 : Evaluation of the Department and its Faculty

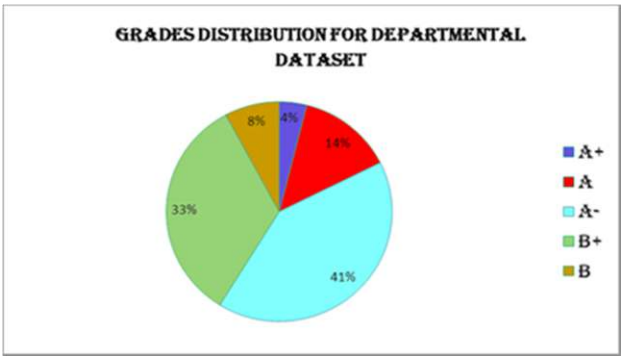

Fig. 3 : Pie chart reflecting Grades

Before figuring out how to grade each department, it's essential to see how well discrete techniques for classifying data for data mining work with the dataset. K Nearest Neighbor, Classification and Regression Techniques, Linear Discriminant Analyzer, Support Vector Machine, and Random Forest techniques are used to compare the different classification methods LDA, CART, KNN, SVM, and RF. There is a comparison of the various types of classification, and the best one is chosen. A comparison was made using the data mining tool R. 10-fold cross-validation was also applied to have more precise results. An analysis of different performance parameters for all machine learning models was taken into consideration and the model whose performance indices exceeds others was chosen for final assessment. A comparative study of ML models employed in the dataset is shown in Fig.4. Accuracy was plotted using data from a 10-fold cross-validation study of R classification models used for data mining. To perform cross-validation, a subset of a dataset is removed from the training process. The model is then tested on this saved sample before it is finalized. The k-fold cross-validation method measures the model's performance on different subsets of the training data. The rate of average error in predictions is then determined. When a plot is

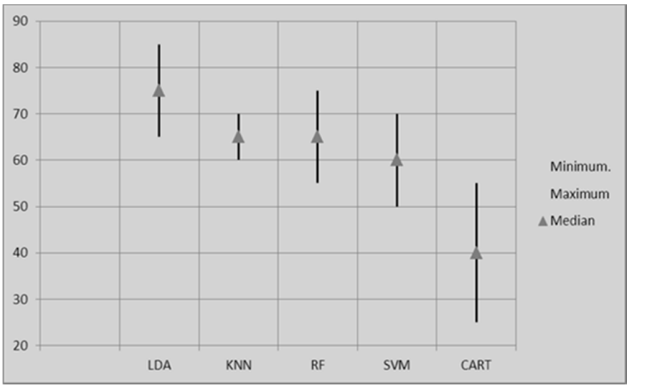

Fig. 4 : Comparison of Various Classification Methods

```
> S1<-which(test$Deptt_Score == 'A+')
> S2<-which(test$Deptt_Score == 'A')
> S3<-which(test$Deptt_Score == 'A-')
> S4<-which(test$Deptt_Score == 'B+')
> S5<-which(test$Deptt_Score == 'B')
> S6<-which(test$Deptt_Score == 'B-')
> S7<-which(test$Deptt_Score == 'C')
> S8<-which(test$Deptt_Score == 'D')
> G<-(sum(length(S1)*8 + length(S2)*7 + length(S3)*6 + length(S4)*5 +
+  length(S5)*4 + length(S6)*3 + length(S7)*2 + length(S8)))
> Grade<-G/NRTest
> FG<-round(Grade)
>  Result<-( if(FG== 8){ print(" Departmental Grade is A+ ")}
+ else if(FG== 7){ print(" Departmental Grade is A ")}
+ else if(FG== 6){ print(" Departmental Grade is A- ")}
+ else if(FG== 5){ print(" Departmental Grade is B+ ")}
+ else if(FG== 4){ print(" Departmental Grade is B ")}
+ else if(FG== 3){ print(" Departmental Grade is B- ")}
+ else if(FG== 2){ print(" Departmental Grade is C ")}
+ else if(FG== 1){ print(" Departmental Grade is D ")}))
[1] " Departmental Grade is A- "
>
```

Fig. 5 : Coding portion in R for Departmental Grading

created to show the accuracy of various data mining classification models for a given set of departmental data. When the accuracy of different classification models is compared, it is clear that LDA is more accurate than other models. So, LDA is used on the test data, which is a set of department data with a unique code as is clear from Fig-4.

The predicted grade for the department can be found by allocating weights to each grade that was used in the task, multiplying those weightages by the total number of faculties that scored the grade, and then adding up all the grades. This number must be rounded up after being divided by the total number of department faculty members in order to obtain the actual grade that the department awarded.

Individual grades of all faculties, as well as the total number of departmental faculties, are necessary to compute the grade of a department in an academic organization.

Appropriate weightages are assigned to each grade in order to calculate the departmental grade. The final grade of the department is derived by dividing the sum of individual product terms of grade by the number of faculties in the department and rounding off the result. As a result, the formula for calculating departmental grade is:

Grade 'D (X)' in course 'X' is determined using the formula shown above. "N" in this formula stands for the total number of faculties taken into consideration for assessment [17]. Number of instructors receiving a "A+," "A," "A-," "B+," "B-," "C," or "D" is represented by PL, QL, RL, SL, TL, UL, VL, WL respectively. Since we have categorized grades into 8 categories, Grade 'A+' having best features receives 8 points, grade 'A' receives 7, grade 'A-' receives 6, grade 'B+' receives 5, grade 'B' receives 4, grade 'B-' receives 3, and grade 'C' receives 2 points. The value obtained for 'D(x)' when rounded off comes out to be the departmental grade. Similarly, after summing all departmental grades, institutional grades can be calculated. Once D(x) for each department present in institute are calculated, the score or grade of the institute can be assessed.

Conclusion And Future Scope

The primary objective of this study is to enhance faculty performance, leading to improved departmental and organizational effectiveness. The analysis of faculty members' professional, research, and other attributes, gathered through questionnaires, assigns equal importance to all factors in the analysis and result generation. The work advocates the use of Data Mining Methods for assessing the efficiency of educational institutions. Recognizing the critical importance of high-quality academic excellence on both local and international scales, this work emphasizes the pivotal role played by teaching faculties in disseminating technological knowledge. It underscores that mentors bear the responsibility of imparting students with exceptional knowledge and skills. Generally educational institutes primarily focus on its faculty academic performance and teaching -learning skills of a faculty. But for a holistic development of the institute, its faculty and students, it is imperative to pay importance to multiple parameters for faculty assessment and the department they are associated with. The parents and students, whether opting for graduate or undergraduate courses, are keen to have an impression of the faculty, department as well as the institute they are allowed to select based on the grades obtained in the entrance examination. To position India as a global education hub and a significant participant in the global economy, the paper highlights the necessity of reinforcing the education system, promoting research, and encouraging development. This study's primary aim is to identify and address prevailing issues and challenges within Higher Education Institutes. It proposes the application of Data Mining's classification method to enhance academic institutions' performance, particularly focusing on departmental faculties. The proposed model also recommends actionable measures for continuous quality improvement and performance benchmarking against peer institutions.

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