APPLICATION OF MACHINE LEARNING TO PREDICT FACTORS AFFECTING QUALITY EDUCATION IN ENGINEERING COLLEGES IN MADHYA PRADESH

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Abstract

The major participants in technical education is engineering courses such as B.Tech. M.Tech. and doctoral programmes. For the monitoring of quality education in engineering colleges, various national and state authorities involved. Recently, the National Board of Accreditation has set standard parameters for the evaluation of outcomes-based education systems. The second parameter has several factors, including the enrolment process, infrastructure of colleges, teaching and learning methods, etc. This paper studies Madhya Pradesh state-level engineering colleges education quality and placement record satisfaction. Madhya Pradesh is the 6th largest state in India population-wise, and it is the core of central India. For the survey of respondents, we selected major cities of Madhya Pradesh, such as Bhopal, Indore, and Jabalpur. The total number of participants (respondents) is 150 students on different levels. For empirical analysis of data, machine learning algorithms such as support vector machines, KNNs, and decision trees are employed. The analysis of results suggests that in Madhya Pradesh, the quality of technical education is alarming.

Keywords: - Technical Education, Engineering colleges, AICTE, Machine Learning

Introduction

Technical education in India has a significant role in shaping the country's workforce and driving its economic growth. Technical education in India encompasses various disciplines, including engineering, technology, architecture, computer science, information technology, and applied sciences. It is primarily offered at the undergraduate and postgraduate levels. The All-India Council for Technical Education (AICTE) is the statutory body responsible for planning, coordinating, and overseeing technical education in India. It formulates policies and regulations, approves new technical institutions, and monitors their functioning. Additionally, professional bodies like the Indian Institutes of Technology (IITs), the National Institutes of Technology (NITs), and other autonomous institutes play a crucial role in technical education. India has a vast network of engineering colleges that offer undergraduate (B.Tech./B.E.) and postgraduate (M.Tech./M.E.) programmes. These colleges provide specialised education in various branches of engineering, such as mechanical, civil, electrical, computer science, and more. The Indian Institutes of Technology (IITs) and the National Institutes of Technology (NITs) are renowned for their quality education and rigorous admission processes. Polytechnic institutes offer diploma and certificate courses in engineering and technology. These institutes focus on practical skills and prepare students for technical jobs. Polytechnic education provides an alternative pathway for students who may not pursue traditional engineering degrees. The curriculum in technical education institutions in India is designed to provide a balance between

theoretical knowledge and practical skills. The AICTE sets guidelines for curriculum development, and universities and colleges follow these guidelines while developing their academic programmes. Accreditation bodies such as the National Board of Accreditation (NBA) and the National Assessment and Accreditation Council (NAAC) assess and accredit technical institutions based on predefined quality parameters. The Indian government has launched several skill development initiatives to bridge the gap between industry requirements and the skills possessed by graduates. Programmes like the Skill India Mission aim to provide vocational training and enhance employability by focusing on skill-based education. Technical education in India faces certain challenges. These include the need for curriculum updates to match industry requirements, faculty shortages, the limited availability of modern infrastructure and equipment, and ensuring quality and uniformity across institutions. Efforts are being made to address these challenges through collaborations with industry, faculty development programmes, research and innovation, and the integration of emerging technologies into the curriculum. The aim is to enhance the quality of technical education and produce skilled professionals who can contribute to India's development. Technical education in Madhya Pradesh plays a vital role in providing skilled professionals in various fields. The state has numerous technical institutions that offer a wide range of courses. Madhya Pradesh has numerous engineering colleges that offer undergraduate (B.Tech./B.E.) and postgraduate (M.Tech./M.E.) programmes in various branches of engineering. Some of the prominent engineering colleges have been mentioned in the previous response. These colleges provide a comprehensive curriculum, combining theoretical knowledge with practical training. RGPV is a well-known technical university in Madhya Pradesh. It offers undergraduate and postgraduate programmes in engineering, pharmacy, management, architecture, and other technical fields. It also acts as an affiliating university for several engineering colleges in the state. Madhya Pradesh has established technical universities that focus on research, innovation, and technical education. These universities provide a platform for students and faculty members to engage in research activities and contribute to advancements in their respective fields. This study analyses several factors influencing college education in Madhya Pradesh. The major cities of Madhya Pradesh, such as Bhopal, Indore, and Jabalpur, are technical education hubs. There are approximately 300 colleges (public and private) in these cities. The study makes use of both primary and secondary data. The primary data for the study was collected from a questionnaire of 150 people. The 150 people include student faculty with B.Tech., M.Tech., and Ph.D. degrees in different streams such as mechanical engineering, computer engineering, and electrical engineering. The collected data are analysed with statistical evaluation using a machine learning algorithm. Machine learning is a very popular tool for the analysis of different factors. The rest of the article is organised as follows: section II discusses work in the field of quality education, section III describes research methodology, section IV discusses experimental evaluation of machine learning algorithms, and section V concludes.

II. Related Work

Despite several bodies at the national level and state departments of regularity authorities, quality education in Madhya Pradesh faces several challenges, such as quality teaching

faculties, good research laboratories, and many other things. The continuous efforts of several academicians and research scholars to design outcome-based education systems and several factors for improving quality education A recently employed study and methodology are described here. The author [1] As scholarly activities are heavily weighted by all accrediting and ranking bodies, such as ARIIA, India (71%), AACSB, USA (48%), NAAC, India (25%), and NIRF, India (20%), research and innovation are continuously promoted in accrediting institutions. The author [2] Apart from worldwide-level accreditation with flexible costs and transparent auditing, international accreditation by private or independent Certifying authorities might be widely recognised due to the less time-consuming method. The author [3] Three significant metrics—NBA accreditation, NAAC accreditation, and NIRF accreditation—define accreditation and ranking. NBA accreditation assesses a programme's level of excellence, whereas NAAC accreditation and NIRF ranking assess an institution's level of excellence. The author [4] The NBA evaluates programmes offered by an institute and only grants accreditation to those programmes, while NAAC evaluates the institution as a whole. In NAAC, 70% of the marks are given by DVV based on the content uploaded by the institute, and the remaining 30% are given by the peer team, whereas in NBA, 100% of the marks are given by the peer team. The author [5] takes into account factors like coding, business communication, English, logical and mathematical skills, and analytical and problem-solving abilities. The statistics are shocking: 47% of graduates can't find work in any area or industry of the knowledge economy. The employability rates for software services, software products, and BPO are 17.91%, 3.67%, and 40.57%, respectively. The author [6] According to the study's findings, the concept of OBE is becoming more prevalent in engineering education in India, but in order to fully utilise the outcomes-based approach, training must be offered in areas such as curriculum design, proper CO writing, assessment, and evaluation processes. According to the author [7], only students with a background in business and management were included in this study, which was conducted using a sample of students from just one university. Similar studies can be carried out with a larger sample size of students from various educational backgrounds and by including additional contextual and motivational factors. The author [8] of this study investigates strategies for raising the long-term productivity of rural higher education institutions in India. The Dwivedi-Joshi Rural-HEII-Model puts out „ just-now-long-term concerns" for enhancing ranking and certification for not just „ STEM," but also for management, social science, spirituality, and humanity. he author [9] of the suggested study uses BSC as a performance indicator to evaluate an institution's research and development efforts. For the evaluation of the R&D efforts, the four BSC viewpoints are taken into account. For the purpose of assessing an institution's research and development efforts, a survey of a few key variables is taken into account. The author [10] The respondent's haziness of judgement is handled by the fuzzy method's conversion of the crisp or real value into a fuzzy triangular set, and TOPSIS selects the option that is farthest from the negative ideal solution and closest to the positive ideal solution using the Euclidean distance approach. The author [11] The suggested competency framework for software engineers does not fully address the fundamental lifetime learning competencies, such as literacy, and is instead focused mostly on

broad professional competencies in math, science, technology, and engineering, as well as in several languages, as well as in areas of personal, social, and lifelong learning. The author [12] Students' opinions of engineering education are generally mixed. However, the majority of them were optimistic about the future of engineering education, and parents cited the availability of job opportunities as the main reason why their children chose engineering as a career. The author [14] The analysis demonstrates that the institutions differ significantly in terms of funding sources, patterns of income and expenditure, the link between costs and fees, and the degree of assistance provided to students from India's lower social and economic strata. The author [14] Focus group discussions are used in this study to learn more about how students, HEI staff members, and employers at Omani HEIs perceive the most important standards established by the Oman Academic Accreditation Authority (OAAA) in evaluating HEI quality. The author [15] Today, there are many different sources of income, and even homemakers can make money while they are at home. The use of branded items and income are directly related. Additionally, in a developing nation like ours, the allure of using branded goods has accelerated the end-of-season sale concept. According to the author [16], in the current study, a framework for PEIs to improve their service quality has been proposed, and many factors to do so have been prioritised. The Indian state of Madhya Pradesh has developed a framework for service quality improvement for PEIs. The author [17] As each methodology has its own restrictions, this study also identifies Scrum's limitations, including those related to project documentation, planning, large-scale projects, distributed environments, team capabilities, etc. The author [18] The mean absolute percentage error and mean squared error of all test locations are less than 2.5 and 0.0176, respectively, and the correlation coefficients are greater than 0.96, demonstrating the high dependability of the model for predicting the wind speed within the research area. The author [19] It emphasises the consequences of evaluating student performance and offering feedback from the standpoint of engineering education. The report concludes by making some suggestions for improvement in engineering education institutions' assessment and feedback procedures. The author [20] Curriculum and academic support were discovered to have no significant influence on PBC or SN. However, it was found that all of the EI antecedents had a strong positive relationship with both family and peer influence. According to the author [21], for worldwide standard performance, they must be required to have excellent facilities for ongoing regular training before and during their term. IHE has only ever been fed as a child and breastfed as a baby; he has never been emancipated or overregulated. The author [22] In-depth interviews were used to gather the qualitative data in addition to surveys for the quantitative data. Ninety heads of programmes responded in the first round, and ten of those heads were then chosen for interviews. The interpretation step included the Integration of all stages 'findings. The author [23] In accordance with our extensive work on the ABET accreditation process for three different computing programmes, we have created crucial recommendations for delivering outcome-based education. The effective implementation of suggested recommendations promotes long-term quality practises in academic programmes. The author [24] This essay suggests a systems-based strategy that entails input, morphology, and output in order to help engineers develop employable abilities.

The abilities necessary for the target roles in the industry and the graduates' traits are the sources of the programme outcomes, which include technical and professional skills. The author [25] Engineering programmes have been accredited in order to ensure that the graduates are of the highest calibre. Engineering universities are implementing ongoing changes to the teaching-learning process. The author [26] Additionally, it has empirically proven the value of online education since the 19th century. In reality, social media may help to further enhance learning outcomes as e-learning emerges as a new method of strengthening the learning process. The author [27] The current study aids educational planners, decision-makers, and administrative staff in designing an efficient plan and system to improve the ,, service quality "of Indian PEIs. The author [28] The HeIs may follow a route towards autonomy, quality, and accreditation, and they may develop into multidisciplinary universities. Making institutions accountable to stakeholder's centres on autonomy. Utilising the institute's full potential will eventually result in increased responsiveness and Innovation. According to the author [29], it has been noted that many Vice Chancellors have fallen short in their efforts to serve as mentors and motivators for their institutions 'researchers. The results of a comparative study on research performance-based grading were confusing, and little variation was seen in university grading based on important indicators. According to the author [30], it becomes important to make both minor adjustments to the teaching-learning process and substantial adjustments to the assessment tools in order to execute OBE effectively. In this research, the technique for implementing OBE and measuring programme and course outcomes in Tier-I Indian Institutes is presented.

III. Research Methodology

A survey is undertaken to get the responses of students and faculty members of three major cities in Madhya Pradesh, such as Bhopal, Indore, and Jabalpur, on the process and their opinions of quality education parameters. It includes undergraduate, postgraduate, and doctoral students. Also, teachers of some reputed engineering colleges like LNCT, OIST, UIT-RGPV, and some others participated in this survey. Questioners were prepared and circulated to students and teachers through Google Forms, and responses were collected. We collected 150 anonymous responses; students and faculty members were not required to disclose their identities. The questions included in the questionnaire are:

1. Physical infrastructure of colleges
2. Admission procedures of colleges
2. Location of colleges
3. Placement record of colleges
4. Teaching Learning methodology
5. quality of teaching staff in colleges
6. laboratory facilities of colleges

The questions were written so that it would be possible to gauge how well the participants knew the various procedures and concepts associated with high-quality instruction in engineering colleges. It asked questions about how to define quality education, how to frame ranking

statements, how to design a curriculum, how to use various teaching techniques, how to use unconventional assessment methods, etc.

Total 150 questionnaires are categories into three sections, in first Ph. D student 10 questions for B. Tech student and 100 questionnaires for M. Tech student and another 40 questions for survey.

Table 1 selected college for collection of data

College	City	Total Colleges	Cover
Sagar Institute of Research & Technology (SIRT) Bhabha College of Engineering Jai Narain College of Technology (JNCT), Oriental College of Technology Scope College Of Engineering NRI Institute of Information Science and Technology Maulana Azad National Institute of Technology, Bhopa people's college of engineering , BHOPAL Bansal Institute of Science and Technology RKDF college of Engineering Truba Institute of Engineering and Information Technology IES Institute of Technology and Management Radharaman Institute of Research and Technology Lakshmi Narain College of Technology Excellence (LNCTE) Central Institute of Petrochemicals Engineering & Technology	Bhopal	104	15
Institute of Engineering & Technology, DAVV SKSITS Engineering College Sri Aurobindo Institute of Technology, Indore Institute of Science & Technology, Institute of Engineering & Science, IPS Academy Prestige Institute of Engineering Management & Research Shri Govindram Seksaria Institute of Technology and Science Malwa Institute of Technology Lakshmi Narain College Of Technology VITM - Best Engineering College	Indore	59	10
Gyan Ganga Institute of Technology Saraswati Institute of Engineering & Technology			

Radhaswami Institute of Engineering	Jabalpur	25	5
Shri Ram Institute of Technology			
Laxmi Bai Sahuji Institute of Engineering & Technology			

This section describes the table of student data collection sheet, the total data collection is 100 and the rating of question is marked as 1-2, 2-3, 3-4, 4-5, the mark of rating covers the factors such as good, very good and excellent.

Table 2 data representation of questioner 100 of B.Tech Students

Question	2		3		5	
1	Answer	1-2	Answer	2-3	Answer	3-5
2	65	1	45	1	85	0
3	70	1	49	0	95	1
4	80	1	88	1	78	0
5	35	0	84	0	49	1
6	90	0	50	1	67	1
7	95	1	98	0	50	0
8	78	0	65	1	30	0
9	89	1	71	0	65	1
10	59	0	25	1	86	1
11	35	1	78	0	56	0
12	45	1	64	1	59	1
13	38	1	91	1	97	0
14	95	0	81	1	85	0
15	60	0	85	1	70	1
16	75	1	90	0	97	1
17	25	1	75	1	75	0
18	63	1	55	1	80	1

19	79	0	60	1	95	1
20	88	1	80	0	90	1

Table 3 data representation of questioner of 40 M.Tech Students

Question	2		3		5	
1	Answer	1-2	Answer	2-3	Answer	3-5
2	39	0	31	1	16	1
3	30	1	34	0	10	0
4	35	1	15	1	15	1
5	14	0	18	1	31	0
6	20	1	22	0	25	0
7	25	0	28	1	29	1
8	27	1	38	1	31	0
9	29	0	33	0	36	1
10	34	1	19	1	35	0
11	28	1	27	1	22	0
12	37	0	12	0	28	1
13	33	1	19	1	31	0
14	35	0	26	1	29	1
15	29	1	36	1	34	0
16	10	0	39	0	36	1
17	15	1	40	0	25	0
18	18	1	19	1	21	0
19	20	0	25	0	40	1
20	34	1	29	1	38	1

Table 4 data representation of questioner of 10 Ph.D. students

Question	2	3	5

	Answer	1-2	Answer	$2-3$	Answer	3 - 5
1	8	0	3	1	9	1
2	4	1	6	1	7	0
3	1	1	9	0	5	1
4	3	0	5	1	4	0
5	5	1	7	0	3	1
6	7	0	2	1	8	1
7	5	1	5	0	2	0
8	3	0	8	1	8	1
9	4	1	6	1	2	0
10	6	0	2	1	5	1

The survey of questioners sampled in tables 2, 3, and 4 as B.Tech., M.Tech., and Ph.D. students The ranking of questions is marked as 1 to 5 and is ready for the matrix formation for machine learning algorithms.

IV. Experimental Analysis

This section explores the behaviours of sampled questioners. For the static analysis, we employed three well-known machine learning algorithms, such as support vector machines, KNNs, and decision trees. For the experimental process, MATLAB software is used as a tool. MATLAB provides all functions and programmes of machine learning algorithms for data analysis. The description of the employed algorithm is described here.

A. Support Vector Machine (SVM)

Support vector machine is a powerful and widely used tools for data classification and function evaluation[32]. The processing of data sampling in support vector machine employed linear separation and non-linear separation. The working of support vector machine like binary classification algorithm. The non-linear support vector machine mapping the feature data with respect to one plane to another plan. The separation of data plan is non-linear and decision factor correlate with margin function of support vector. The hyperplane of equation is derived as

$$WD.xi + b \geq 1 \; if \; yi = 1$$

(1)

$$WD.xi + b \leq -1 \; if \; yi = -1$$
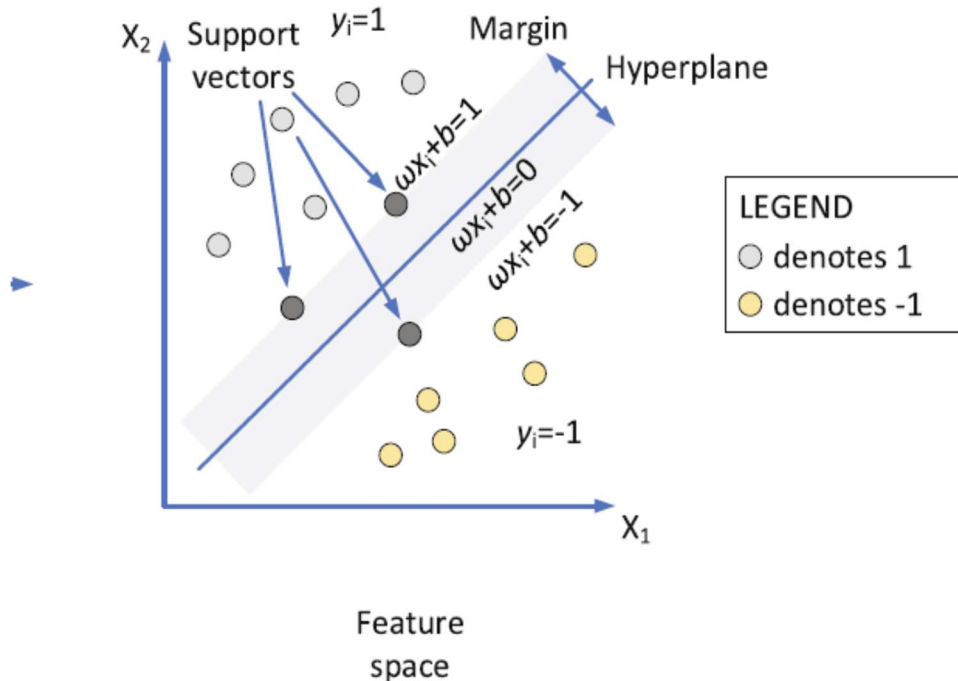
Here W is weight vector, x is input vector yi label o class and b is bias.

Figure 1 process block diagram of support vector machine.

The minimization formulation of support vector

$$Minimize \ \frac{1}{2}||w||2 + C\sum_{i=1}^{n} \varepsilon i \ , i = 1,2, \dots \dots, n$$

$$subject \ to \ y_i(w^T D. x1 + b) \geq 1 - \varepsilon 1$$

$$\varepsilon_i \geq 0 \ i = 1,2, \dots \dots, n \dots \dots \dots \dots \dots \dots \dots . (2)$$

Here C is constant, n is number of observation and $\varepsilon 1$ is slack variable.

The rule of decision function is

$$f(x) = \sum_{i=1}^{n} yi\alpha iK(xi, xj) + b \dots \dots \dots \dots \dots \dots . (3)$$

B. KNN

The KNN classifier is simple algorithm of machine learning, it also knows as lazy classifier[31]. The classification accuracy of KNN classifier varies in range of 70-80%. The major utility of KNN classifier in case of pattern recognition. The KNN classification algorithm applied on the case of continuous nature of attribute. The processing of KNN algorithm describe here

1. Estimate K training attribute which belong to unknow attribute
2. Chose the common occurring classification of K

For the estimation of similarity in class of K instance applied different distance equation. The very famous distance equation is Euclidean distance equation.

C. DECISION TREE (DT)

A decision tree is predictive model of data classification. The processing of decision tree algorithm follows the tree structure of feature set. The partition of branch applied the concept

of maximum entropy. The feature attribute has maximum entropy treat as leaf node class[31]. The learning process of decision tree algorithm is very simple and suitable for the prediction of medical data analysis. The decision tee rule formation according to the behaviours of feature attribute narrated in terms of maximum occurrence of probability. The core algorithm of decision tree is C4.5. the processing of these algorithm on design of tree in manner of top to down as class label. The entropy and gain are two functions manage the processing of decision tree algorithm. The performance of algorithm measure as precision, accuracy and recall. The formulation of these formula is

$$\text{Precision} = \frac{TP}{TP+FP}$$

$$\text{Accuracy} = \frac{TP}{TP+TN}$$

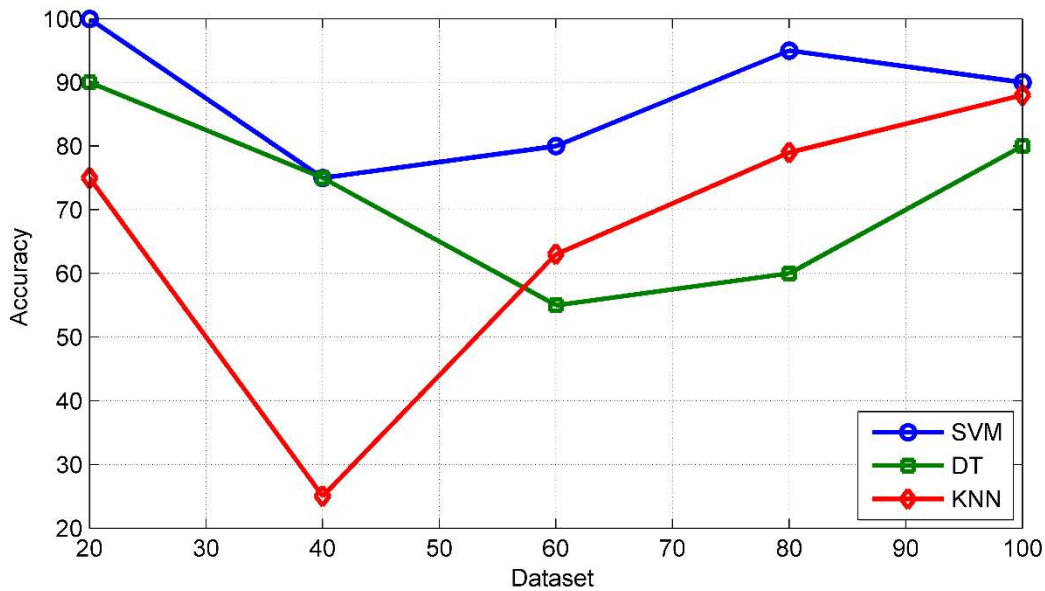$$\text{Recall} = \frac{TP}{TP+FN}$$

Figure 2 performance analysis of student data collection accuracy using this method SVM, DT and KNN.
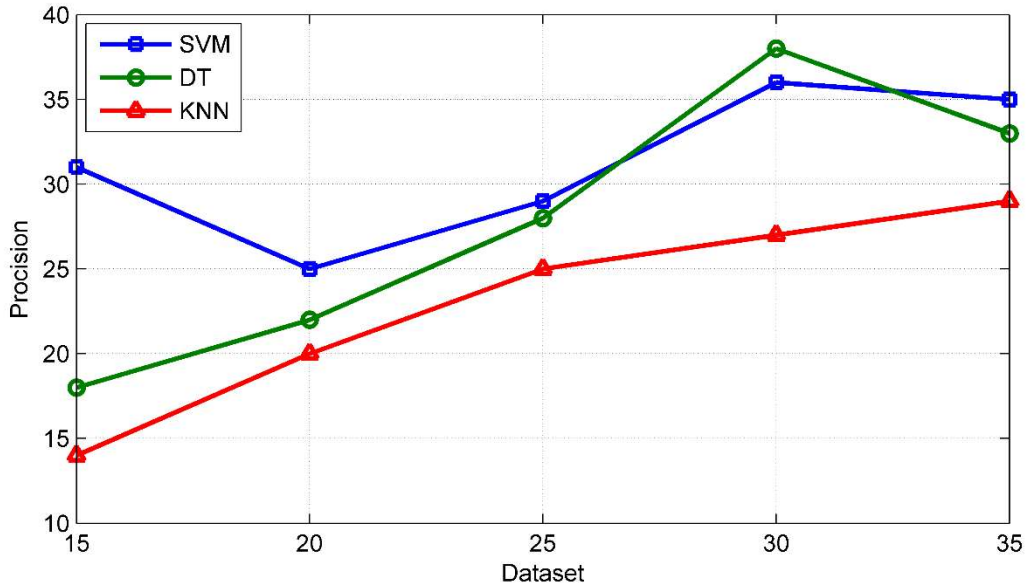
Figure 3 performance analysis of student data collection precision using this method SVM, DT and KNN.
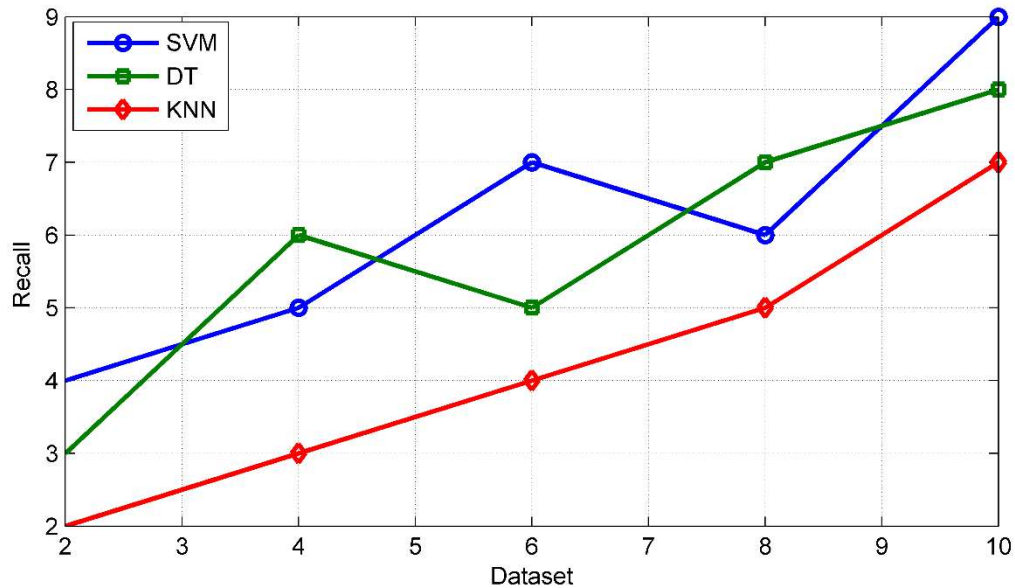

Figure 4 performance analysis of student data collection recall and dataset of using this method SVM, DT and KNN.

V. Conclusion & Future Scope

A number of stakeholders are extremely concerned about the quality of technical institutions' educational offerings due to the alarming rate at which they are proliferating in India. Under the current conditions, ensuring the quality of technical education has in fact grown to be a Herculean task. It is imperative that NBA consider changing its current policy, standards, and procedures in accordance with the suggestions made in this paper in order to:

- Enhance the assessment's accuracy and dependability;
- add more quantitative elements

- get rid of or minimize subjectivity
- Enhance acceptance by institutions and assessors
- make the assessment quick and easy
- add transparency to the process.

In this study, three machine learning algorithm were applied to pinpoint the elements that influence a quality education in engineering colleges in Madhya Pradesh. To support the results, domain experts were consulted. It is advised that the university offer faculty members useful workshops on effective advisory techniques. Domain experts recommended that academic advisors have soft skills like emotional intelligence. These abilities will be useful for providing professional academic advising as well as helping faculty members run advisory sessions more effectively. The best way for students to get the right advice and make sure they are on schedule is to meet with their academic advisor frequently.

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