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Higher Education Recommendation System Using XG-Boost Algorithm

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Abstract: *Educational institutions have a huge burden when dealing with students with low academic performance (at-risk students). Many approaches support this group of students, such as psychological therapy, proper scheduling for at-risk students, appeals, personal training, mock tests, direct private education, or success centres. However, these methods are not enough to solve the problem, because other factors affect the student's success, which can be his family difficulties, cognitive style, previous performance and level of education. This paper explores machine learning models to predict at-risk students and then builds a recommendation platform to provide such students with direct systemic coaching to remediate the fragmentation of their knowledge and skills. We use a dataset of 554 students from a computer program; the study aims to break down the curriculum into a set of chunks of knowledge and skills used to measure students' progress throughout their studies. We used different machine learning algorithms, a decision tree with an accuracy of 82.68% (Positive class: Good condition) and a high coverage of 87.69% (Positive class: Good condition). We completed model optimization and used ROC comparison to compare classifier models. A remediation algorithm is used to support high-risk cases, which leads to a sharp decrease in the risk level. The study found that current applied approaches to dealing with at-risk students exaggerate the problem and students should not be treated en masse. Keywords: Machine learning, Coaching education, Pre-admission assessment, Personalized education recommendation system, Educational disparities, At-risk students, Student retention*

Keywords: *Educational institutions*.

I. INTRODUCTION

The advent of information technology is transforming education by introducing new technologies such as massive open online courses (MOOCs), mobile learning and blended learning. The advantages of MOOC learning include low cost, remarkable efficiency, and the ability to learn on the go and in small chunks [1]. But most courses are mostly video-based and lack contact and connection with lecturers, which is not ideal for deep learning. Learner-centered principles suggest that hybrid learning modes combine significant advantages of online and traditional classrooms for both students and teachers [2]. It is safe to say that educational reformers around the world are increasingly turning to hybrid teaching approaches to better explore and expand high-value educational resources [3]. Software development, platform enhancements, and instructional practice all fall under hybrid education research. Armando Fox was the mastermind behind the creation of the MOOC. A typical classroom on campus increases the degree of quality of education. Student responses to teacher questions are combined with self-directed study and testing in SPOC (Small Private Online Course), a hybrid learning technique described by the researcher. The author examined components in common SPOC circumstances such as learning needs, learning strategies, material preparation, assessment and evaluation [4]. However, hybrid education does not solve several fundamental problems. These are the following:

(i) How do students' online learning habits reflect their personal learning preferences?

(ii) Do both of these online learning habits have the ability to predict future performance?

(iii) How can the findings be used to help students improve their academic performance in the classroom in the future?

The most important subfield of ML in data mining uses data mining to find useful information in vast amounts of data for the development of AI (artificial intelligence). Ayala's machine learning consists of "learning from experience" and "optimizing analysis by reviewing findings" [5]. Machine learning methods such as logistic regression, decision trees, neural networks, Bayesian networks, clustering, and support vector

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machines are all standard. Big data is a cutting-edge new technology that can transform many industries. Data mining in education is a hot new research topic that is both a manifestation of current research in digital education and a sign of a looming need [6]. Using EDM, an entirely new field of study, it is possible to better understand students and their learning settings. Semester data is often collected from online courses but is not used to improve student performance in a traditional offline classroom setting [7]. To solve these problems in hybrid education, this paper uses machine learning to help instructors better understand students' online behavior, target students' learning styles, and pay more attention to students who need help [8]. To achieve our goals, we first formalized the online learning analysis problem using machine learning methods and then built a prediction model[9].

Recognition is the final step in the process. One of the hottest topics in technology is the rise of artificial intelligence (AI) [10]. Conceptually, it allows robots to learn from a range of circumstances. Statistical artificial intelligence is a branch of computer science that uses statistical methods to enable computers to "learn" and make decisions [11]. Many businesses use it to help them perform better, but it also has some interesting applications in education. Many children now prefer to pay someone to do their homework because they do not understand what they are learning at school [12]. Machine learning can help students improve their academic performance by analyzing and recommending the best learning technique. There is much more to machine learning than what people have seen in recent years, and it has the potential to transform the entire education system [13]. The method of education in which students receive a personalized learning experience tailored to their needs is called "learning" [14]. With the development of machine learning algorithms, our teaching methods and curriculum can be tailored to the individual needs of each student. With the development of machine learning, it is now much easier to enable personalized interaction to adapt to the needs of the individual and provide better education [15]. The software assists the student in determining which courses to take. However, ML-enabled software also recommends study materials and teaching methods that are better suited to a student's learning style. With the development of machine learning, schools and universities can now better organize and manage their content and curriculum [16]. Thanks to this, work is better distributed, because everyone's potential is better understood. This method makes it easy to determine what works best for individual instructors and students. When machine learning makes learning easier for teachers and students, students become more engaged and interested in learning and participating. It goes without saying that it improves the efficiency of the education system. In addition, machine learning helps educators become more productive in solving problems such as classroom management and planning [17].

Teachers can now devote their energies to tasks that AI and machine learning still cannot accomplish. Teachers are often confused by the materials they use to teach their students. When teachers get stuck in the middle of a lesson, students miss out on important insights and insights. Using machine learning-based learning analytics, teachers can improve their understanding of their data. In teaching and learning, teachers go through a huge amount of material,analyze it, interpret it and draw conclusions from it [18]. In addition, learning analytics can help determine the best course of action for each individual student. There are several benefits for students as well, as the software provides recommendations for resources and other learning methods. Many companies have benefited from the predictive analytics capabilities of machine learning over the past few years [19]. On the other hand, predictive analytics in education seeks to better understand the thinking and demands of students as individuals, not as a group. It is also a good way to prepare for the changes that are likely to occur in education in the near future. Teachers can learn a lot about their students' strengths and weaknesses by looking at the results of class tests and midterm assessments. This will provide teachers and parents with information to help each student. Thanks to this, teachers will be able to help students more comprehensively [20]. As some may have already discovered, it helps educators better understand the unique needs of each student. It is now possible to offer a customizable learning model where students can take control of their learning with this feature. Students can choose their own pace of study. Thanks to machine learning, students now have more freedom to tailor their education to their interests and choose which teachers and curricula they want to study [21]. It is now possible to create an educational environment tailored to the needs and interests of each student. Machine learning is also revolutionizing evaluation. It can grade papers and tests with greater accuracy than a human. As many people have noticed, OMR answer sheets were (and still are) a difficult procedure to control. There was also the possibility of making a mistake when evaluating papers. Rating can be more accurate. Machine learning ensures that results are as accurate as possible, even when human intervention is required. Machine learning arguably

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provides a more valid and reliable way to assess student performance. It will take time for all educational institutions to become familiar with the possibilities of machine learning. More efforts are needed to fully exploit these technologies in educational settings [22]. However, machine learning and artificial intelligence have already had a positive impact on the educational environment. Thus, this study implements a similar classification for the analysis of pedagogical and pedagogical knowledge. The contributions of this work are as follows:

(i) This study focuses on the classification of education and pedagogical knowledge by implementing a similar classification algorithm based on machine learning (ML-SCA)

(ii) ML-SCA aims to classify similar instructional videos and make recommendations to improve teaching and academic knowledge for teachers and students

(iii) ML-SCA is compared with existing neural networks and K-means algorithms

Motivation to study. Education in education research focuses on determining how knowledge-providing academic institutions will need to adapt to purely online education in a relatively short period of time. People found out how students perceive online courses, their ability to definitely help, and how they use educational and learning platforms in this regard. An online survey was conducted based on a medium-structured questionnaire. Data were provided for teaching classes from academic institutions. According to the findings of the study, Romanian universities cannot prepare for purely online learning. Machine learning is used to educate and train students on knowledge performance indicators. A similar classification algorithm is used in the classroom to support children's physical and emotional development. A few students only disagree with the ML-like classification algorithm and try to define it as an eventual tilt against innovation ability and subjective learning method.

II. MATERIALS AND METHODS

While machine learning is an important thing that is popular these days, introducing the concept of machine learning into the development of the education system is even worse with its activities. First, the platform is designed for the classroom; second, there is courseware that the instructor can use and distribute to students who want to learn or are enrolled in the course. Additionally, a third option is a platform that allows students direct access without the teacher's knowledge. Before 2010, there was no online education system and even now it had little impact on the participants. Right now the whole world is sitting on online applications. However, due to the pandemic circumstances, the methods of communication between students and teachers are not through online platforms. When analyzing data mining concepts, it is most important to deal with current algorithms and modern data methods for the development of technological prospects. When the constraint of the algorithm is increased, it will also affect the utilization of the system. It was only after the completion of the survey report that it was analyzed whether machine learning would affect the education system or not.

The algorithm used in machine learning to improve the country's education system is made possible by the fact that the checking work is done by the system itself and not by a separate faculty. It will be possible to create new tasks only after saving the student's input data set to the cloud. The author deals with algorithms similar to Naive Bayes, ID3, C4.5, etc. Here the classification of the input data set is done for the final decision and workflow for the machine. With the help of 35 attributes and almost 700 instances, machines are operated using such an algorithm. Monitoring is the process of carrying out all the tasks that are mandatory for student management. From the first week to the last week of learning, the machine should act as a teacher and instruct the student from the test reports. At the same time, the accuracy of the results is taken from the SVM reports with 90% accuracy, and the naive Bayes algorithm fits with 80% accuracy. If multiple datasets were collected, the output would alternate. Finally, the most important thing is that the student should be satisfied with the machine-led learning. Anyway, tutorial videos and recommendations are recorded using video sessions, but authorization and management are entirely performed by a user-input algorithm, and the architectural representation is shown in Figure 1.

They use machine learning to educate and train students based on knowledge performance indicators. A similar classification algorithm supports the physical and emotional growth of children in the classroom. Some students disagree with the ML-like classification algorithm (ML-SCA), defining the similar classification algorithm as a possible tilt against the innovative strategy and approach to mental education. Ideas developed from student experiences must be

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evaluated in terms of these instructional requirements and opportunities for talent growth and by measuring the growth of knowledge through scientific and technological innovation in education.

Its classification algorithm appears to be a learning-based technique that uses training data to determine a category based on new observations. Classification is the process of learning software from a data set or observations and then classifying the new observations into one of several classes or groupings. According to the study's conclusions, Romanian universities will not be able to educate students for online learning only. Students are educated and trained using machine learning to measure knowledge performance. A similar classification algorithm is used to improve the physical and emotional development of children in the classroom. A few students are only against the ML-SCM (ML-SCM) classification algorithm, trying to characterize it as a possible bias towards innovative talent and a subjective educational technique.

An observation-like classification algorithm is represented by an x-score. The equation below illustrates the similarity between x and the student dataset in kxj. X

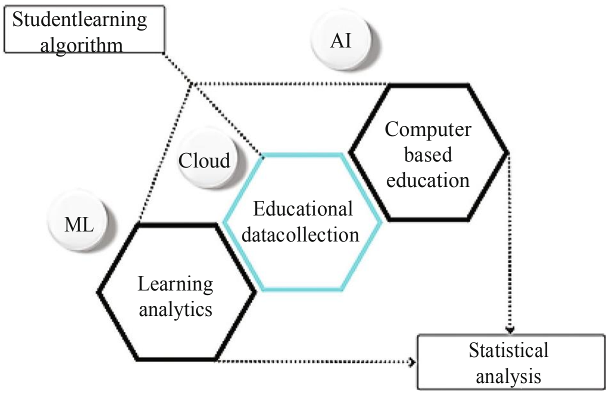

Figure 1: Workflow model for an ML algorithm in an educational system.

-score represents an observable similar classification algorithm. The following equation T represents the similarity between ω and also the dataset for students in |x | following

$x \; = \; {}_{x}\!\longrightarrow$ ☞^{x} ——— — 1ð$Tx\omega - \delta$Þ $+ sT\varphi$: ð1Þ

Here, the mean data represents δ, the standard deviation represents φ, and x is specified as the number of students. In this case, δ is a function of human willingness and φ is a perception of activities in educational systems, followed by educational and pedagogical knowledge.

= x☞$^{s}\longrightarrow$ 1$Tx_{xsF} - Ts$ + ð$Tx_{\varphi} - \delta$Þ: ð2Þ

*Ts*is represented as mean and it is treated as the direction of vector, and *xsF*is represented as standard deviation and is composed of the random example. As a result, the vector of direction *Ts*can also be written as

= ☞$^{\varepsilon = 0}\longrightarrow \beta 0 + \beta 1 Txi + \varepsilon oi$: ð3Þ x

In equation (3) $\beta 0 + \beta 1 Txi + \varepsilon oi$represents the pedagogical teaching using similar classification algorithm framework. As indicated by equation (4), ð$Tx - Ts$ Þ/xsFa centralized repository is an educational framework that ties society that has lost its crucial role in teaching.to identifying the unjust progress of an ð$Tx - \delta$Þinformation

R

$R\longrightarrow$☞1γi ~ pRffiffi 2 +$\gamma R - 1$i : ð4Þ

$\gamma_i$is specified for a random variable; the γ/pγ2 + R − 1 standard deviation is being used to standardize the variable's modifications. Equation (5) is used to $\sum_{s=1}^{v=1}\lambda^{msv}/\varsigma^{msv}$determine the minute scalability variance.

MSV = ☞s=1φmsv+ pγ2 +R − 1 : ð5Þ

msvis specified as minute scalability variance utilized in

λ^{msv}= ☞^{v}=i1 expvTið − αÞ^msv: ð6Þ

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From teaching configuration to a present level of determining similar classification algorithm through implementing its equation, the goal is to educate people in a thorough and simple order to incorporate educated predetermined attitudes and ethics that are suitable for specific mental factors. $T_i$is specified for a random variable, $\gamma_c$is specified for coefficient variation, and exp v is specified as the expected value in

$$\theta\text{sm}= \text{i=1}T\ \text{pexpi}v\ Ti\eth \quad - \quad \alpha\text{Þmsvffi2} + \gamma c= \text{msv}Ti : \quad \eth 7\text{Þ}$$

Students think that education seems to be the objective and also that the topic of education is about more than education; advancement, admiration, recognizing, service, and support enable students to enhance their skills. If we define $x = \eth x1, x2\text{Þ}$ and $w = \eth a,-1\text{Þ}$, then we obtain

$$F\ x\eth\text{Þ}i= \alpha x1 = x2 + b = 0 + \quad = 1, \quad \text{if } R{:}x + b < 0{:} \quad \eth 8\text{Þ}$$

students in theX_nÞ. The similarity between theThe observation mean is represented bykXjis demonstrated inxand the database of college$X= \eth X1, X2, \cdots,$

$$\text{k k}X \quad = \sum_i \sqrt{X_1^2 + X_2^2 + \cdots + X_n^2} + \sum_{x=1} \quad =0\text{Þ}$$

δ is specified for the functional derivative with regard to the x function assumed to be a variable and independent, while equation (10) is kept unchanged.

$$X = \text{i}^b\ \alpha x_1 = x_2 + b = 0 + \eth TX - \delta\text{Þ}: \quad \text{———} \quad \eth 10\text{Þ}\ x_{=1\ \omega}$$

ω is represented as the first limit ordinal denoted by this symbol. It is signified as ω and identifiable by the centages as in equation (11). Inpexpiv$\eth Ti - \alpha$Þmsvffiorganised variety of environmental per-$_X = \eth X^1, X^2\text{Þ}$, the sense of tasks in education systems and educational teaching has obscured.

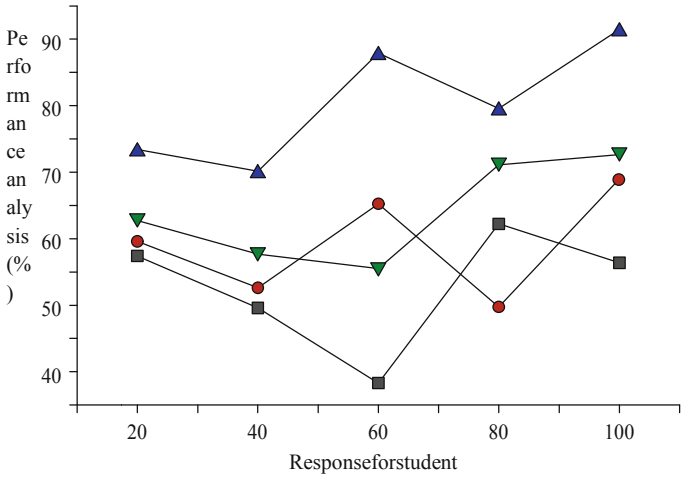

Figure 2: Performance analysis for the number of educational and teaching knowledge using the machine learning-based similar classification algorithm.

Table 1: The result of student record educational and teaching knowledge using the similar classification algorithm.

Number of responses	Turning point and conflict	Option-based position	Education value	Important model of education
20	57.74	59.63	73.13	63.25
40	49.52	52.65	69.73	58.24
60	38.16	65.34	87.64	55.87
80	62.27	49.76	79.36	71.65
100	56.38	69.12	91.27	73.12

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III. RESULTS AND DISCUSSION

β0 + β1Txi + εoi represents the pedagogy based on a similar classification algorithm based on machine learning. As shown in the equation below, the ðTx − Ts Þ/xsF centralized repository is an educational framework that binds to the identification of unfair learning progress ðTx based on a similar classification ðÞ of the information society that has lost

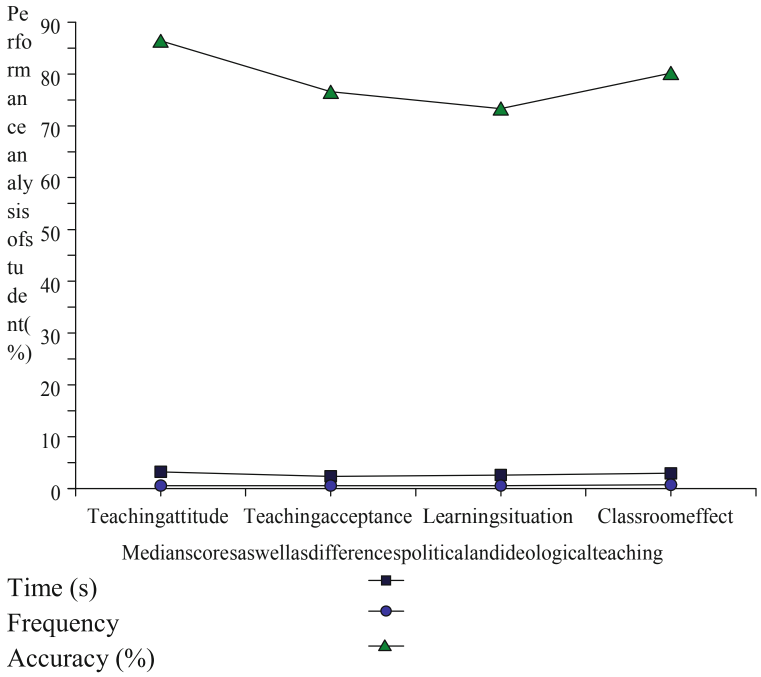

Figure 3: Median scores and differences in educational teaching statistics using the similar classification algorithm with machine learning.

its key role as an infection algorithm as shown in Figure 2, which is a data analysis technique that can also derive the most value from data processing by analyzing and altering the underlying data. Machine learning methods can easily detect trend lines in information, even though the data processing is usually extremely intelligent and the amount of free data is relatively large. Table 1 shows the ML-SCA result in the option context

Table 2: Analysis of Mean Score and Difference Results in Pedagogical Learning Statistics Using Similar Classification Algorithm with Machine Learning Statistics.

Student	Similar classification algorithm Performance analysis (%)		
	Time (s)	Frequency (%)	Accuracy
Teaching attitude	3	0.765	86
Teaching acceptance	2.5	0.853	76
Learning situation	2.7	0.793	73
Class room effect	3	0.884	80

position, education value, importance model of education, and turning point and conflict.

ML-based educational teaching covers topics such as position of effect approach, defining moment, disagreement, and educational value, as shown in Figure 3. The percentage of adaptation in each of these subjects is shown in Table 2. According to the ideological and methodological model, individual people they resulted in an intellectual and social education of suggestion, a certain type of development and reasoning. γi is specified for the random variable; the standard deviation γ/pγffiffiffiffiffiffiffiffiffiffiffiffiffiffiffiffiffiffiffiffiffiffiffi2 + R − 1ffi is used to standardize the modifications of the variable. Equation (5) is used to determine msv the minute variance of scalability. In aspects of the framework of social

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and intellectual education, for the conceptual scientific process, see Figure 3, and so the pedagogical theory and practice of connections and connections were integrated into reasonable teaching methods.

A similar classification algorithm can obtain the best possible solution in data processing by analyzing and modifying

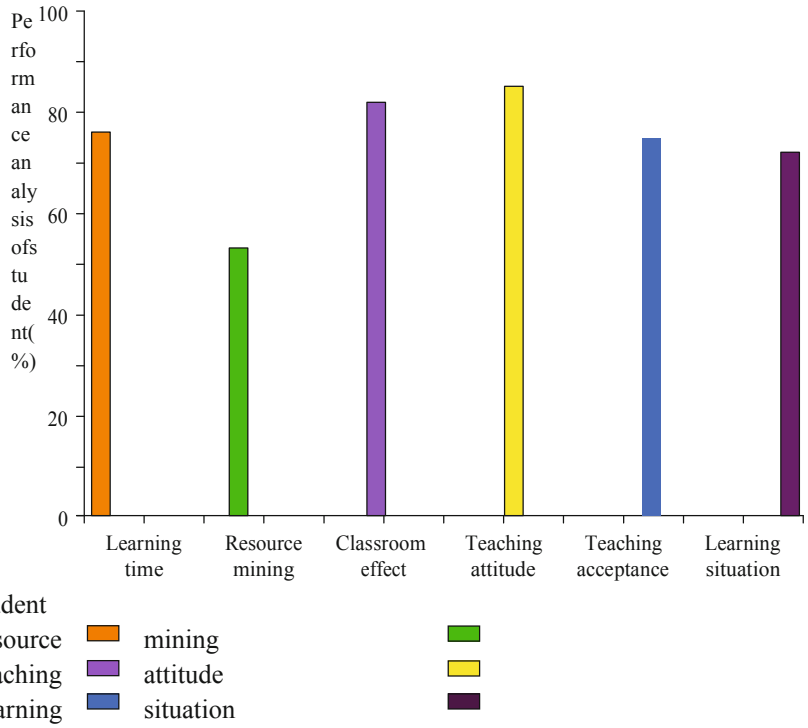

Figure 4: Performance analysis for educational teaching management number of reviewed students using the similar classification

the underlying data. Machine learning methods are difficult

Table 3: Performance result analysis for educational teaching management using the similar classification algorithm with machine learning.

Student	Similar classification algorithm Performance analysis (%)	
Learning time		76
Resource mining		53
Class room effect		82
Teaching attitude	Accuracy (%)	85
Teaching acceptance		75
Learning situation		72

to detect trends in information, although data processing is usually more complex and there is a large availability of information. The observation mean is represented by X = ðX1, X2, ⋯XnÞ. The similarity between x and the university student database in kXjfirst limit ordinalis demonstrated in equation (9). ω is represented as denoted by this symbol. It is referred to as ω and identifiable mental percentages. According to pexpðTi − αÞmsvXffi = organized environmental diversity-ðX1, X2Þ the sense of tasks in educational systems and educational teaching is obscured. The revised student is shown in Figure 4. The use of analysis and search data technologies in student ideological and pedagogical teaching makes it possible to analyze predictors of the work of subnet teachers and assess their extensive functionality, and

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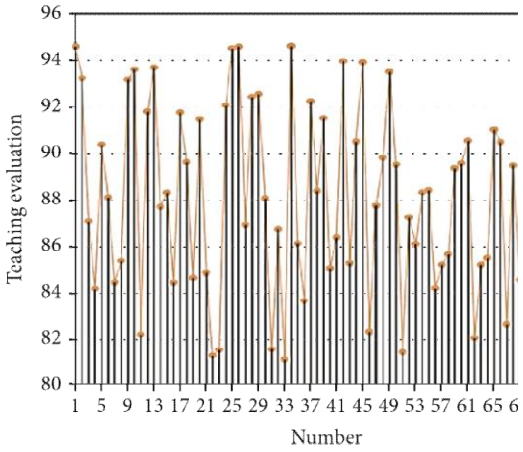
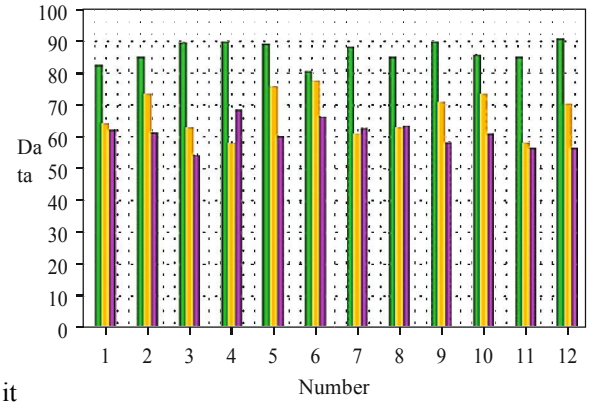


Figure 5: Statistical representation of the influence of teaching evaluation using machine learning. improving lesson planners for students and precise placement to improve learning. Table 3 shows the result. The effectiveness of the system is verified based on the above analysis. In terms of decision analysis, the real need is to verify the performance of the college classroom teaching method using the example of higher education as shown in Equation (5). Through the evaluation, her teaching technique and the students' learning technique are evaluated and statistically analyzed with quantitative evaluation. Teachers and students review the system after using



it

Similar classification algorithm
Neural network K-means

Figure 6: Comparison result analysis for the existing method.

in universities for a long time. First, this article verifies the impact of teaching evaluation on the system. If we see that ðαÞ = X2/kXk, the direction vector cos ðθÞw= X can also be 1/kXk and written with the results shown in Figure 5.

In this research, we analyze the effectiveness of the prediction model in problem extraction of high-performance teaching methods using machine learning and comparable classification algorithms and the effect of statistical problem mining.

Since cos ðβ − αÞ = cos β cosX1/kαX+ksinY1/βkYsink educational teachingα is shown in the equation below, the centralized repository of the framework is the educational framework that connects to the identification of X2/kXkY2/kYk disproportionate development of the knowledge economy. the following equation (16), which has lost its essential place in the teaching of life. Figure 6 shows the results. It is also clear from this paper that the evaluation results of the teaching planning process are more logical and also the formulation has some significance for teaching techniques. Consequently, the system model presented in this paper offers some advantages for updating teaching tactics.

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IV. CONCLUSION

Machines have always obeyed commands prepared by humans or users since the dawn of time. Using computer software, the machine learned to work consistently with its design. It has a significant impact on the growth of both the IT industry and the education system. Support Vector Machine (SVM) and Learning Management System (LMS) use machine learning algorithms to address the need and development of higher education systems. A similar machine learning-based classification algorithm (ML-SCA) is used to classify learning and teaching knowledge in this proposed system. To help teachers and students improve their academic knowledge, ML-SCA categorizes similar instructional videos. Neural network and K-means algorithms are compared with the new SCA. The proposed ML-SCA is found to be 92% more efficient than current algorithms.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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