A New Fuzzy Logic Attendance Assessment System

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Abstract:- Among the universities or any educational institutions, the strict rules associated with the student attendance assessment is the major issue that is discussing nowadays. Various researches or studies are conducted to analyze the correlation between class attendance and the student's performance as a whole along with the positive and negative outcomes thus their conclusions were vague. However, this research is conducted to introduce fuzzy logic related to solve attendance assessment issues among universities and other institutes. The outcomes for resolving this issue includes the outcomes of the previous researches along with the observations collected from staff members from different departments of the university. There are four characteristics of given fuzzy logic result that includes; 1) Attendance marks of the students in the class, 2) Assignments and presentations marks, 3) Quiz marks of the student and 3) Midterm examination marks of the student. All these results can be considered for the allowance of the student in final term examination. This fuzzy law and fuzzy logic can be used for getting the benefits of it that develop precise software attributes resulting in accurate software approximates. This research is based on the evaluation of 330 student's results of AIU dataset. The 14 membership functions of fuzzy logic were utilized. The implementation of the MATLAB's fuzzy logic control technique occurs as the methods of the research. The fuzzy logic is more famous in prognosis when the MATLAB Fuzzy tool is used. Through this tool, the implementation of the fuzzy logic membership function (MF) led it for prognosis.

Keywords:- Attendance assessment system; fuzzy logic; attendance assesment system using fuzzy logic.

I. INTRODUCTION

In various universities all over the world, there is an attendance criterion for every programme they provided. The minimum attendance criterion is usually 60 % - 75 % among various universities that indicates the student non-appearance in the exams if he/she did not target the minimum attendance and the repetition of the semester will be compulsory to appear in the exams. This strict rule of attendance led the students to suffer a lot as if the student is left only from the 5-10% to reach the minimum attendance criterion he/she will lose the entire academic year without even appearing in the exams (Masum, et.al, 2018, pp .121-130). The absentees must have different causes, some of them can be absent because of some serious issue or the fact that in this advancing time in which the knowledge can be gained by the information technology such as tutorials, book reading via internet and through the other advancements, such restriction would be too despotic for the students in their career building just because of the appearance in exams wholly depends upon the attendance. In this research,

the solution to this big issue is considered to propose, that is a new Fuzzy logic attendance assessment using MATLAB's fuzzy tool for the control of the attendance system and the 14 membership functions (MF) of the Fuzzy logic system are utilized for the assessment of students (Kharola, Kunwar& Choudhury, 2015, 4(9)). The fuzzy logic is basically the computing technique that operates many automated assessments of the students that include all types of examinations such as attendance assessment etc.

The aim of identification and recollection has become a great requirement for security. The utilization of face identification software has been utilized to mitigate humdrum activities nowadays (Pradeep, et.al, 2015, pp .43-53). This era of automation has exploited and degraded the people and it has been proved through many types of research. The methods that relate face identification and recollection are the major ideas of Image Processing. As the range of errors was increasing because of the manual working, the requirement of the automation has become necessary. These automated systems basically run as the biometrics (Masum, et.al, 2018, pp .121-130). The need for authentication and recognition is fulfilled by these systems as it provides the error-free and relevant data than the manual workings. Similarly, this type of automation is also considered necessary for the attendance record of the students in universities. In past years, the method used for taking the attendance of the students was manual method done by the lecturers itself by calling the names of the student at the starting of lecture or after it ends, there are many chances of missing any student's attendance if he/she is out from the class for a relevant reason at the time of taking attendance (Kharola, Kunwar& Choudhury, 2015, 4(9)). For such reasons, the automated attendance systems are developed for the accurate attendance taking and save data.

The founding of an association between attendance and performance would assist professors applying different policies and it will have a wider outcome in notifying the policy makers in higher educational field.

However, these techniques have exploited the individual a lot and endangered their career as well (Cabrerizo, et.al, 2015, pp .1109-1118). Many of the students have already lost the opportunity to attempt the exam just because they haven't reached the minimum attendance criterion as the attendance rule is so strict and automated.

The rest of the paper is organized as follows. Section II describes the literature review on attendance assessment systems. The proposed fuzzy-logic based attendance assessment system is discussed in Section III as Research Methodology. The data analysis and results are presented in Section IV. Finally, the paper is concluded in Section V.

II. LITERATURE REVIEW

Many types of research and studies were conducted related to the fuzzy attendance assessment systems with the student's performance or many other variables (Masum, et.al, 2018, pp .121-130). The researches also conducted to find out the factors affecting the student's performance in the examination. Many of the researches also evaluated the correlation between the student's attendance and their performance in academics and proved that the attendance has positive as well as negative effects on the students in examinations (Montazer& ArabYarmohammadi, 2015, pp .482-492). Other researches also explained that the students in Asia usually have a positive attitude towards their studies that permits them to give high performance in their academics. The better and positive learning attitude provides the motivation of attending the classes regularly that totally depends upon the lectures given. It has also proved by a research that attendance of the lab associates with the exam marks that means the attendance of a student in the lab led to high their exam marks (Pradeep, et.al, 2015, pp .43-53). Also, through a study, it has described that the student's absence and their attaining of grades are inversely related.

To maintain a record of attendance there is a need for automated attendance system in every organization, university, school or any other institute (Cabrerizo, et.al, 2015, pp .1109-1118). The benefit of the system is to provide the complete data of the students in the university. The feature of these systems is that the data saved on a permanent basis regularly and can't be changed or removed. Through this system, the attendance of the student is noticed and saved in an individual attendance dataset. The regular and monthly records of the attendance of the staff members and the students of school and access to the attendance data are provided by this database (Alfaro, et.al, 2015). Moreover, a research also suggested the effect of time devotion by students to many course tasks on the performance of the students. Through the findings, it has explained and proved that the quality time devotion in a course was only when the student attends the lectures in class. As the time is a major component of success that has to be managed and the time spent in the classroom is the basic quality time that promotes the student's performance in all examinations and class tasks (Kharola, Kunwar& Choudhury, 2015, 4(9)). Some of the researches also proved that the time attended in the class provides the better explanation of the assignments, projects, lectures and debates that gives a description of the course very clearly that explains the necessity of the class attendance.

Furthermore, the research is analyzed on the students of the UK university to analyze the usual impact of class absence on student performance (Cabrerizo, et.al, 2015, pp .1109-1118). Through its findings, it has proved that the console features of the data were also used to manage the unnoticed difference among students and hence for domesticity among student's absence and student's performance resulting from the usual impacts of struggle and capability on both absence and performance. Across other outcomes, it is also analyzed that there is a usual impact of absence on performance among students.

Also, the fuzzy logic theory is introduced in various educational institutes for resolving of the issues regarding the student's attendance, performance, assessments etc. (Kharola, Kunwar& Choudhury, 2015, 4(9)). Various researches are conducted with the application of the fuzzy logic acts in the universities. A research analyzed that the fuzzy logic related grading technique has many benefits rather than the other casual techniques (Masum, et.al, 2018, pp .121-130). The outshout of a Fuzzy Probabilistic Neural Network model for prognosis individualized student performance was analyzed in a combination of cultural statistical models along with the cultural back-proliferate neutral networks.

It has been assumed that class attendance has a definitely positive effect on student performance. However, there have not been any attempts at attendance assessment, particularly with the objective of allowing those with low attendance to appear for exams if they meet other related criteria. Therefore the proposed system has been developed to identify those students who may have missed classes due to some convincing reasons but should not be disqualified from appearing for examination if their academic performance is good otherwise.

III. RESEARCH METHODOLOGY

This research was analyzed on the students of the university. The attendance of the students in the class is calculated as the percentages of attended classes of a course. It produces the usually utilized quality for determining the eligibility of the student for the appearance in final term examination of the individual course (Montazer& ArabYarmohammadi, 2015, pp .482-492). Therefore, as noticed that there were few students that couldn't attend the class because of the multiple and authentic reasons, for example, due to medical problems such as maternity, surgery, illnesses etc. or replacement or due to abominate the teaching ways of a teacher. Yet they should get a chance so that maybe they can have the ability to perform better in the examination. However, the consideration of attendance of the students for the decision of their appearance or rejection in the examination is not appropriate (Pradeep, et.al, 2015, pp .43-53). There are some limitations of the conservative systems that are considered to represent the fuzzy logic dependent expert system for the decision of principles for the refusal of the student to appear in the examination.
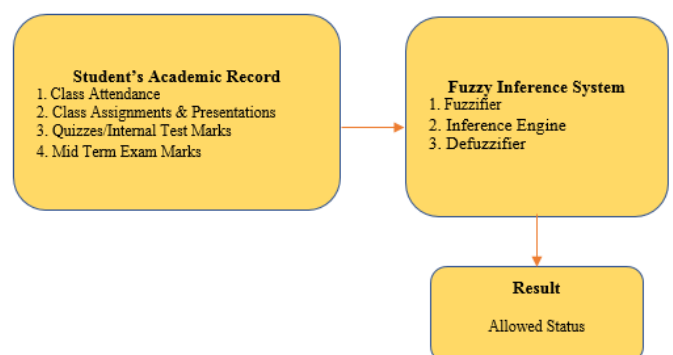

Fig 1:- Model of Fuzzy Attendance Assessment System

In figure-1, the system model of the Fuzzy Attendance System is provided. This supposed system consists of four

behaviors of the performance of the student for the decision of permitted students for the examination.
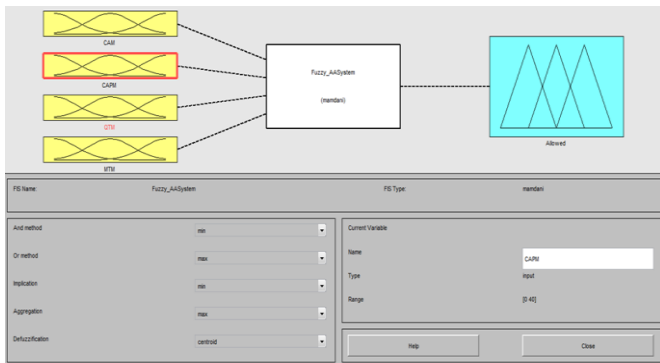

Fig 2:- Mamdani FIS developed using MATLAB

In figure-2, there is an image of the given FIS produced utilizing MATLABR2014a. The four (4) inputs characteristics include attendance marks of the student; assignments and presentations marks of the student; quizzes marks of the student; midterm examination marks of the student and the only output characteristic is allowed.

Input	Descriptor
Class Attendance Marks (CAM)	Very Poor
	Poor
	Good
	Very Good
	Excellent
Class Assignments and Presentations Marks (CAPM)	Poor
	Good
	Excellent
Quiz and Test Marks (QTM)	Poor
	Good
	Excellent
Mid Term Marks (MTM)	Poor
	Good
	Excellent

Table 1. Input variables and their descriptors

Output	Descriptor
Allowed	No
	Chance
	Yes

Table 2. Outputvariable and their descriptor

➢ *Input Variables*
A. Attendance in class

The percentages were calculated for the class attendance on a course of about 0-100. According to Table-1, the variable is showed in accordance with five fuzzy sets that are named as Excellent, Very Good, Good, Poor and Very Poor. The research was conducted at Alhamd Islamic University, Quetta-Pakistan where the minimum criterion for the attendance is 75% that is compulsory for an appearance in the examination. The University allocates the attendance assessment given by the teacher is of 10% weight age.
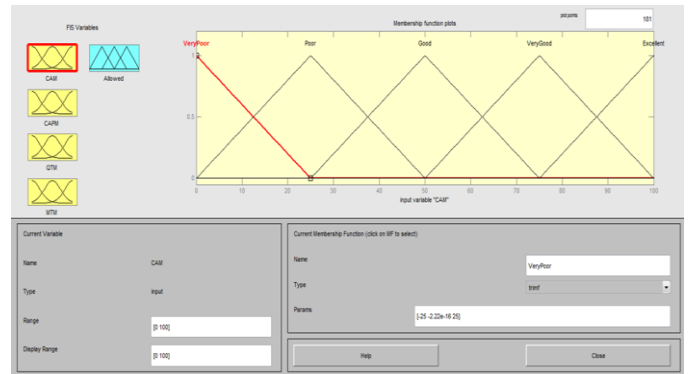

Fig 3:- Membership function of input variable: Class Attendance Marks (CAM)

B. Class Assignments and Presentations

This is another variable deal with the department assignment and presentation of a course of student. This variable consists of the assignment and presentation of a specific course that is given by the teacher to a student and the student outside of class performance regarding that assignment and presentation, for example, the excellent project regarding course is submitted to the teacher on time. The particular university allocates the assignment assessment given by the teacher is of 16% weight age. The variable representation is on a scale range from 0 to 40. This variable is showed in accordance with the three fuzzy sets that are shown in figure-4 and named Excellent, Good and Poor.
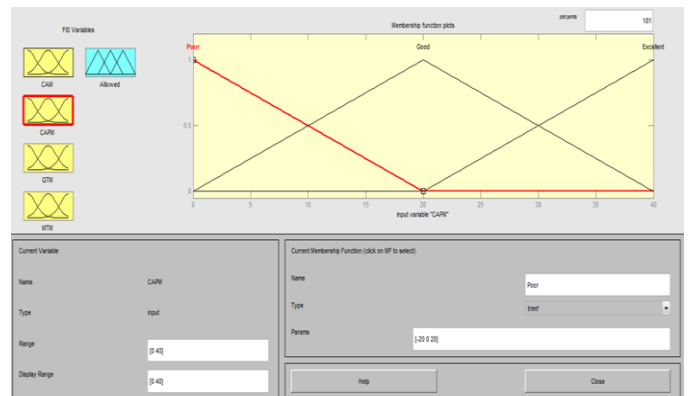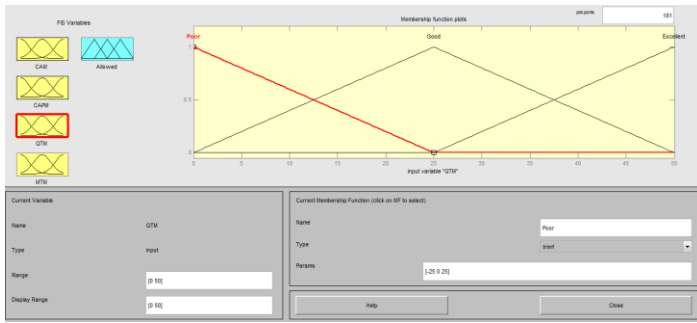

Fig 4:- Membership function of input variable: Class Assignments/Presentation Marks (CAPM)

C. Quizzes Test Marks

The following variable deals with the quiz tests of a specific course of a student taken by the teacher. This variable consists of the quiz assessment taken by the teacher of an outside of class performance, for example, the good performance of the quiz related to a specific subject. The University allocates the inner assessment of a particular course that is taken by the teacher from the student of about 4% of net age. Therefore, the variable is showed on a scale range from 0 to 50. This variable is showed in accordance with the three fuzzy sets that are shown in figure-5 and named Excellent, Good and Poor.
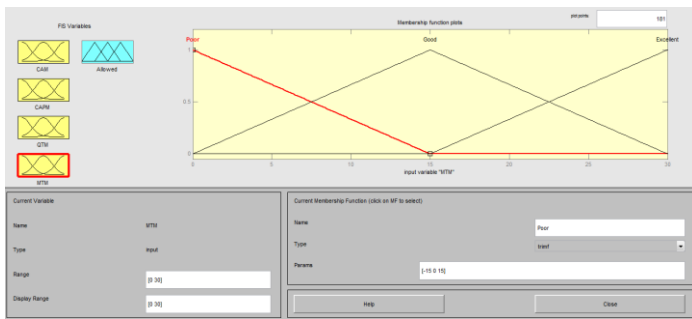
Fig 5:- Membership function of input variable: Quizzes/Interior Test Marks (QTM)

D. Mid Term Examination Marks

This variable alters the progress of a student in the ongoing course. The variable shows that if the student got good marks in the overall midterm examination and he/she has low attendance than criteria, it indicates the ability of the student to have self-instruction or self-teaching. In the university, the net age provided to midterm examination is 30%. Therefore, the variable is shown from the range of 0 to 30. This variable is shown in accordance with the three fuzzy sets shown in figure-6 and named Excellent, Good and Poor.

Fig 6:- Membership function of input variable: Mid Term Exam Marks (MTM)

E. Output Variable

The proposed model consists of an output variable named as Allowed. Basically, it consists of the decision of the faculty about the student's prohibition from the examination or the opportunity should be provided to the student by the allowance of appearance in the examination. According to Table-2, the output variable is shown on a scale ranges from 0 to 100 utilizing the three fuzzy options represented in figure-7 and named as No, Chance and Yes. "No" indicates that student can't sit in the exam, "Chance" indicates that the student is permitted to give the exam depends upon some situations for instance, if the student has submitted the assignments or scored high in quizzes etc. "Yes" indicates that the student is eligible for the examination and can sit in final exams.
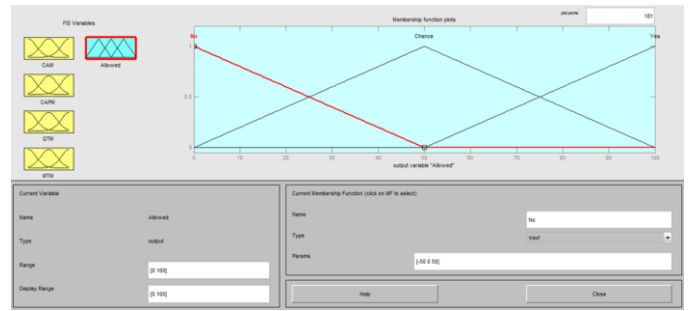

Fig 7:- Membership function of output variable: Allowed

F. Fuzzy Principles

The fuzzy principles depend upon the fourteen (14) input behaviors and the percentage of the output variable named as Allowed on which the decision is taken. The student will be allowed to attend the examination not only when the attendance of the student is high than the standard level that is 75% in the introduced university but, also if the other variables have disregarded percentages. Hence, the fuzzy logic gives the solution that if the student's attendance is low then the 75% then the next predisposition will be the marks taken in assignments and presentations. Moreover, the next consideration will be the quiz test marks and depends upon the condition when the student couldn't attend the classes because of the inevitable and authentic reasons. Furthermore, it is also observed that various students faced the anxiety during the exams because of which they don't attempt a good paper or their handwriting got disgusted but they gave better performance in assignments and projects, this observation is taken by the quiz test marks variable. Predisposing all these situations, the researcher got fourteen (14) fuzzy impact rules or principles. The detailed of the fuzzy rules/principles is represented in figure-8.

Fig 8:- Fuzzy Rules/Principles

IV. DATA ANALYSIS AND RESULTS

The given model is implicated utilizing fuzzy logic toolkit of MATLABR2014a. The researcher has planned a Mamdani fuzzy inference system along with the four input variables, one output variable, and fourteen principles. Mamdani technique is consumed by crisping the fuzzy set system. After this process, the rule of maximum immediacy is implicated to decide to give the permission to the student to sit in an exam or the refusal or rejection. The rule of maximum immediacy is utilized to explain the fuzzy set to which a

component the researcher relates. If the researcher got fuzzy sets Ai, that proposes

$$Ai(u) = \max \{A1(u), A2(u), A3(u), …, An(u)\} \qquad (1)$$

This equation can be contemplated that the component comparatively relates to Ai equation. The last decision is taken from the crisp percentage of the variable "Allowed". Figure 9-11 indicate the surface plots of all four input variables along with an output variable.
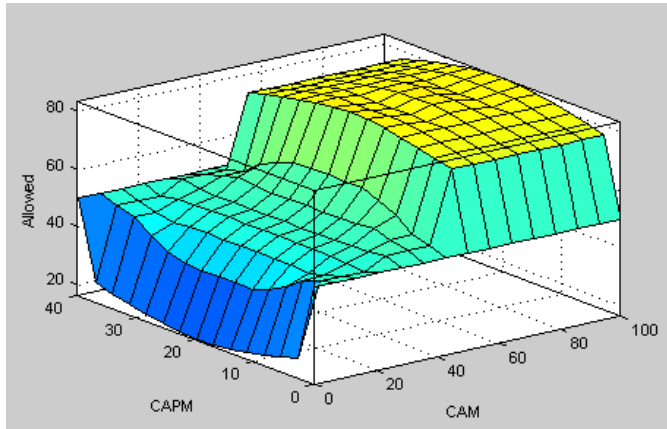

Fig 9:- Surface plot of Assignment and Attendance of the Class with Allowed
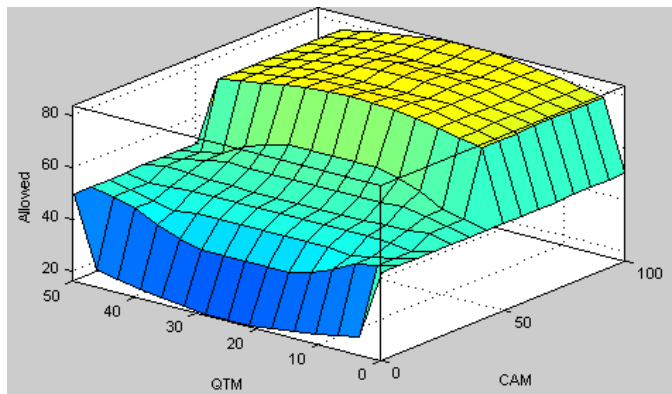

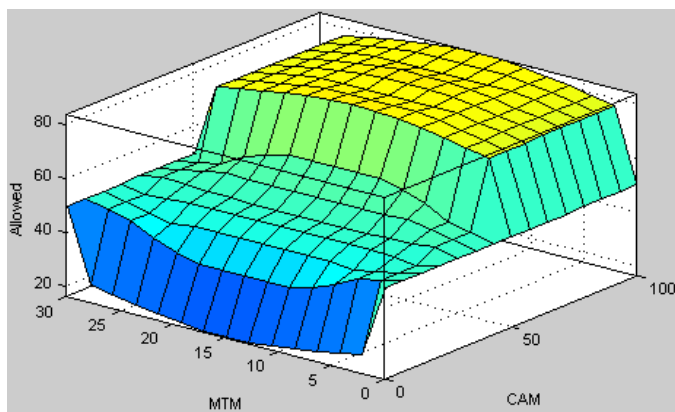Fig 10:- Surface plot of Quiz test of class and Attendance with Allowed

Fig 11:- Surface plot of Mid Term Marks and Class Attendance with Allowed

The proposed model has been tested for real data of BSCS students for the subject software engineering and assessed for the given data by the participants of about 330 students from the Alhamd Islamic University, Quetta-Pakistan. Data analysis of a few students is given in Table-3.

S#	CA (0-100)	CAP (0-40)	QTM (0-50)	MTM (0-30)	Total (220)	Per (100)	Fuzzy Result	Allowed
1	25	5	5	5	40	18%	33.8	No
2	25	10	10	10	55	25%	46.2	No
3	30	15	20	15	80	36%	51.1	No
4	35	20	25	15	95	43%	54.0	No
5	40	20	25	15	100	45%	59.1	No
6	40	35	40	25	140	64%	63.0	Chance
7	45	35	40	25	145	66%	65.2	Chance
	48	20	20	20	108	49%	73.9	Chance
8	50	15	15	10	90	41%	63.0	Chance
9	50	20	25	15	110	50%	83.7	Yes
11	60	20	25	15	120	55%	81.7	Yes
12	70	20	25	15	130	59%	83.1	Yes
13	80	20	25	15	140	64%	83.1	Yes
14	90	20	25	15	150	68%	81.7	Yes
15	100	20	25	15	160	73%	83.7	Yes

Table 3. Data Analysis of Tests

No	Chance	Yes
0-59	60-74	75-100

Table 4. Parameters

Most of the students that are not permitted to appear in final examination because of the low percentage of attendance got permitted according to this model for the appearance in final examination and this is the achievement of the proposed model.

V. CONCLUSION

This research was conducted to propose a model that helps in the issue resolving regarding the attendance of the students and the allowance of appearance in the exams. The proposed model is given by the fuzzy logic attendance assessment system using MATLAB technique. Through the findings, it has evaluated that the proposed model is very beneficial against the strict rules of attendance considered in the universities. However, the results showed the great opportunities for the students that have genuine problems due to which they can't attend the classes regularly. Although, in this time of vast information technology, the consequences of these technologies provide the benefits and the disadvantages both. The management should give the chance to the students only considering the authentic proofs or genuine reasons regarding not attending the classes. Otherwise, the students will take advantage of this model and will endanger their career by themselves.

In this research, the four inputs were considered and through the fuzzy technique, it provided an output that consisted of the Allowance or Non-Allowance of the student of appearing in the final term exam. Along with the consideration of the 4 variables that are assignment and presentation marks,

quiz test marks, midterm exam marks and the attendance in the class, the decision about the appearance in final exam was taken. Because of the low percentage of the attendance, the other 3 variables performances were considered. However, many of the students that would be failed in their final term examination without even attempting it, were allowed through this model. Although, this model should be considered in other universities as well as those have strict criteria of the attendance as it can lose the student's career development and endanger their lives.

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