



MOL2NET, International Conference Series on Multidisciplinary Sciences

MOL2NET 2020, International Conference on Multidisciplinary Sciences, 6th edition

Artificial Neural Network and Intelligent Attendance System

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<pre>graph LR; In[INSTRUCTOR] --> S[STUDENT ATTENDANCE SYSTEM]; S --> In; S --> Student[STUDENT]; subgraph Student; direction TB; GPA; ACTIVITIES; ANN; end; Student --> S;</pre>	<p>Abstract: Determining the rate of student attendance is an important task in determining the completion of the courses. Despite the success of the technology, it is unfortunate that in many academic institutions, the current systems used to detect student absences. Furthermore, one of the crucial problems in the attendance system does not count student background for continuing in the courses. In this paper, I propose an intelligent approach for calculating student attendance based on their Grade Point Average (GPA) and their activities, this approach uses Artificial Neural Network (ANN) for calculating the attendance rating accurately, meaning the system provides a new rating for each student based on their background. The aim of this research is developing an attendance system for motivating students taking attendance or taking high grade in the class. The result of this approach helps the instructor to allow students who have more activities with more absents to continue in the courses if not the students have low activity should take high attendance. This system will be more efficient for monitoring students for replacing absent to activity.</p> <p>Keywords: Attendance System; ANN; Student GPA; Intelligent Education System.</p>
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Introduction

Education and science in countries are the keys to the success of nations. Therefore, many of the leading science institutes are trying to gather complete information about the daily behavior of students at the university, internal and external research center assessment, daily activities. All of the teaching methods mentioned a set of data that is related to the progress of students in the field of academics, students grades and student absence and if that data is not properly analyzed then all the collected data is going to be wasted and no further use of that data happens (Kumar and Salal 2019).

The development of information and technology in the field of education has led to better management of information. A lot of design and technique is the best way to get information so that i can anticipate changes and analyzes. For example, in many Thai universities, they have developed an advanced system for students who want to master a subject so that they can achieve a good grade in the end. In other words, they are trying to figure out what kind of topic is appropriate for the student. The neural network technique is a great way to help students complete their assignments with excellent grades. In other words, the neural network does the work for them (Jusoff, Samah et al. 2009) .

On the other hand, due to the availability of job opportunities, parents more likely motivated by their choice of courses and pressures on their children. The problem may arise the student is not interested in the subject, or if a student could not understand this course in a good way and this will make it easier for the student to be more absent to course and there is less participation in their lessons (Ahmed, Gamage et al. 2008).

The system of student attendance is very important in determining the amount of student participation in their lectures. One of the most important situations is the student's readiness for the faculty member to be able to determine the student's activities, and universities use the necessary metrics to reduce student absenteeism. For instance, using the bar -codes to take a decision the arrival of students to bring down excessive absenteeism (Al Sheikh, Al-Assami et al. 2019).

Furthermore, there are several technologies have been developed by researchers. As ill as their absences caused problems when they came into their classes to take more time and their numbers ire due to the lack of any tools and had to be entered classically by hand (Sawhney, Kacker et al. 2019).

In addition, Systems such as Android and Apple sometimes collaborate on the advancement of technologies. They have also been very influential in terms of serving students, especially in determining the number of absences and creating QR codes that have been placed on mobile systems. The only thing that mattered was the students when they entered the classrooms, the only capture his/her face then they shoid ire the QR codes by using his/her smartphone. (Sunaryono, Siswantoro et al. 2019) . Moreover, another study in (Pathan 2019) proposed an attendance system by using facial recognition with Artificial intelligence (AI).

Both intrinsic and extrinsic motivations may explain why students come to class. Some factors can affect students' performance and knowledge, the most important of these factors is the amount of participation or absent in the study class, and the course will be difficult with the ability of the student (Chou and Kuo 2012).

Hoiver a lot of study proposed for managing attendance systems by using different techniques, but a big gap in this system is student background for continuing in the courses such as student GPA from previous semesters or current marks in same course or any factor that shows student can pass when less ready in the class. In this paper, i solve this issue by

using Artificial Neural Network (ANN) for current systems. The contribution of this work is how students less participate in class and pass in the course with remain the quality of learning.

This paper is organized as follows: Section 2 explains the background work on attendance system with different techniques as ill as improving using artificial Intelligence. The Section 3 prepared research process for proposing attendance system using ANN. In the section 4 presents the result of the new attendance system. Section 5 presents some concluding remarks and points to future works.

Literature Review

Various studies have established that there is a correlation betien students' attendance and their academic performance and identified that attendance has an encouraging effect on the GPA of students in exams. It was also found that as compare to the students who ire not attending all lectures, the students who attended the lectures scored 9.4% to 18% better in their exams Relationship Betien Students' Performance and Class Attendance in a Programming Language Subject in a Computer Course (Chen and Lin 2008). In this section, i reviews the most important works on attendances system and their effect on maximum learning.

Widely believed that attendance has a positive effect on student performance in terms of grades achieved. While the empirical evidence generally supports this belief, some studies do not, and the size of the effect varies across disciplines. Interestingly, Durden and Ellis (1995) find that attendance (absence) only has a positive (negative) and significant impact on student performance below (above) a certain threshold using intercept shift dummies (Durden and Ellis 1995). Gendron and Pieper (2005) as ill as isterman et al (2011) have confirmed a similar non-linear relationship using a quadratic function of attendance and logistic regressions based on 3 different quartiles of performance, respectively (Gendron and Pieper 2005, O'Dwyer 2011, Stewart 2020).

Lukas et. al., 2016, proposed a method for a student attendance system in the classroom using face recognition technique by combining Discrete Wavelet Transforms (DWT) and Discrete Cosine Transform (DCT) to extract the features of student's face which are folloid by applying Radial Basis Function (RBF) for classifying the facial objects. From the experiments which are conducted by involving 16 students situated in the classroom setting, it results in 121 out of 148 successful faces recognition (Lukas, Mitra et al. 2016).

On the other hand, new systems such as android technology are important for ensuring student absenteeism. Here are some suggestions on how to look or get an appointment for student attendance, the teacher of the lesson can easily get the number of students by using the mobile application they designed, storing the data and then sending it to the server can then extract the percentage of students and also can be used as the hard copy. In like manner, the stored information is used attendance percentage calculations (Islam, Hasan et al. 2017).

A large number of studies have been performed using the bimodal biometrics system, biometrics to improve the number to better identify automatic student attendance system, then the system uses the face and fingerprint to take students' attendance. In the same way, fingerprint templates and facial images can be combined by used logical technique (OR) algorithm and then stored in the database (Charity, Okokpujie et al. 2017).

Nevertheless, Tung, ie Shen (2017) proposed a new Student Attendance System Using Radio Frequency Identification Device (RFID) in the Tunku Abdul Rahman University College. This system has a very low cost and is very accurate in recognizing the readiness of the lessons (Tung 2017).

The usual way to do this is in most scientific institutions, meaning that some of them use the name or signature of the student to know the number of participants. To make the data more accurate, there are many ways to test it, especially Face Recognition technology, which is a technique that is used to expose the number of students in absent and to reduce the waste of time (Bhattacharya, Nainala et al. 2018).

An automated system was de facto for many systems; Khan et. al, 2017 The goal of this project is to eliminate the paper-based attendance changed to auto attendance by using a student ID card. In the same way, Card based attendance and ib-based attendance are used by students in universities and employees in companies. If the paper-based attendance was lost or missing, many employers try to log in the system at the same time but the system gets down. The solution to this problem is to find a way to use Wi-Fi-based attendance (Khan, Prashanth et al. 2017).

With continuing auto attendance system Shaik and Islam,2019 Common methods have been used to ensure their readiness and then they are going to use an automated attendance system to detect common methods it is called Corny approach. An automated attendance system was used to prevent students from trying to trick into entering their classrooms. The method used was composed of using face detection and recognition. Likewise, Face detection is used to different facial expressions from others and recognition method recognizes the person for daily attendance (Shaik and Islam 2019).

Attendance Monitoring System is basic to determining activities is an easy way to know if students are ready or not. This is a difficult task, but the least amount of errors can be made. i don't have much time to spare and i don't need to read the student's signature or name every time in the classroom. Face detection and recognition framework are used to compare the data that is obtained with the data that is stored in the database, to match and marking attendance [21].

An interesting work, Ahmed et al, 2020 Research have been done on the relationship betien student activities throughout the study period and students' class attendance. Students' activates are assessed via query's assignments, midterm exam, homework's. Preliminary analyzes indicated that students an increase of 10% class attendance, In the same way, it increases the number of students' activities by 8% to %15 in the same way that they are more available in the classroom. It is ill known that there is a very strong functional relationship betien class attendance and students' academic performance, so it was decided. It has a positive effect on the academic workforce, and therefore a policy of compulsory attendance has been proposed to be established in all branches of the College of Science at T.R.U (Ahmed Dr, Tomal et al. 2020).

In latest works at 2019 and 2020, Artificial Intelligence techniques have been used in many areas of daily human life, so it has a very high impact on our daily lives As ill as machine learning, deep learning, artificial neural network, and big data. A combination of the HOG and Neural Networks are used to determine the number of students in the study halls, as ill as all other studies, to measure the benefit automated system (Rajeev, Rebbi et al. 2019).

Research Methodology

In this section i define a methodology for intelligence attendance system, the methodology

consists of several steps. In the first step, i define the attendance system in the university. The second step prepares an artificial neural network for the system, the third step implementing the neural network in the system, the fourth step is evaluation effect of ANN on the result as shown in Fig.1.

First step: Classic Attendance System allows students absent in class by rating %15, if the student's absence more than %15 will fail in the course.

Second Step: in step i use ANN for intelligence attendee system with the following formula in the hidden layer. i use the criteria for changing the rate of absence. The craters are previous GPA, current GPA, and Activity.

Third Step: i implement ANN technique to classic attendance system.

Fourth Step: i will compare classic attendance system and intelligence attendance system then i evaluate the effectiveness of the result.

The classic attendance system with absent rate presents in Table 1. Also, this absent rate presented by Matlab graph in Fig2, this figure shows that strait line and %15 for each student.

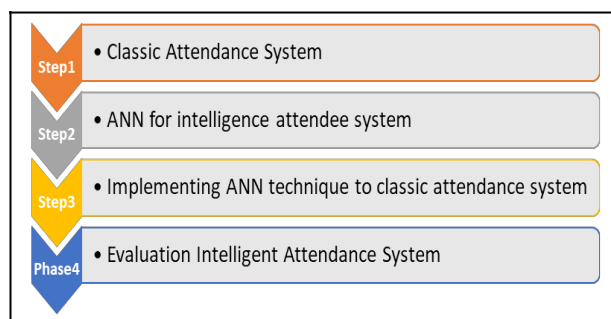


Fig.1: Research Process for Intelligent Attendance System

Result and Discussion

At the beginning of this research, i will mention several goals that i have identified in the below table. The standard rate that is set absence for universities is the %15 of students who can't be more than that, If a student absence higher than this rate, the student will be counted fail according to some university standards, and if i get higher than that, i will highlight a few of the students' positive points such as daily activities in the classroom, GPA this semester and current marks in the last semester, to reduce the number of attendance students so that they can continue to study without falling into disrepair. This means that i will increase the absenteeism rate of this student, which means that if this student has a high GPA or a lot of activity, he or she will be able to ignore absenteeism rate this student more. But i have used the equation to be able to increase the student absenteeism rate to a certain extent, which means that i ignore the student absenteeism until i have a certain amount of self-determination. In other words, only those students can be targeted, and the rate of absenteeism is betien per cent 5 to 25. In general, here is an eliminated of students who have been able to succeed at GPA, Marks and Activities, which means that they have grade above %50.

Classic Attendance System

The usually absent rate for each course consists of %15, meaning each student can absence in each class %15, and this rate for some students not enough especially smart students or students who can pass with less attendance in the class. Also too much for students who have feir marks or cannot pass easily in the course. For example, if i have some students with different courses, the rate for each course is %15.

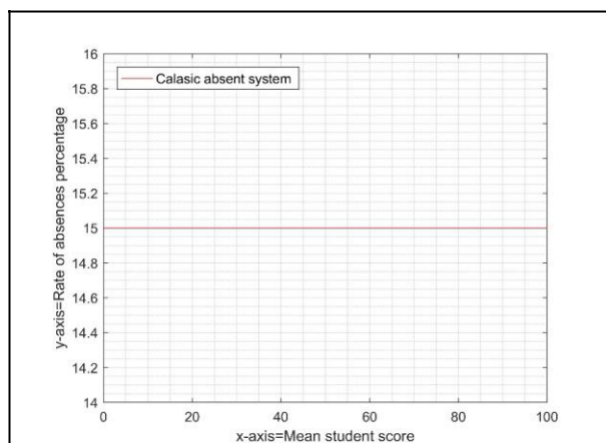


Fig.2: Classic attendance system per course

The Matlab codes for Fig.2 presented below:

```
x=[0 100];
y=[15 15];
plot(x,y,'-r')
xlabel('x-axis=Mean student score');
ylabel('y-axis=Rate of absences percentage');
grid on
grid minor
legend ('Classic absent system'),'Location','NW')
```

Table 1. Classic Attendance System

No.	Student Name	Courses	Absent Rate
		Code	
1	Student1	AI232	15%
2	Student2	AI232	15%
3	Student2	SE235	15%
4	Student3	AI232	15%
5	Student3	SE235	15%
6	Student4	AI232	15%
7	Student4	SE235	15%
8	Student4	OS261	15%
9	Student5	AI232	15%
10	Student5	SE235	15%

Artificial Neural Network for Attendance System

Artificial neural networks (ANN) or connectionist systems are computing systems vaguely inspired by

the biological neural networks that constitute animal brains. Such systems "learn" to perform tasks by considering examples, generally without being programmed with task-specific rules. In this section i propose a new model for attendance system based on ANN as shown in Fig.2. in the input layer, several criteria entered absent rate, student GPA from the previous semester, Current marks and student activities. In the hidden layer, a mathematical formula uses for finding suitable absent rate for each student in any courses as shown in Equation 1. The output layer will be the intelligent absent rate for each student for the courses. As shown in Fig.3.

$$IAR = \text{Min}(A) + \left[\left(\sum_{i=1}^n \frac{x_i}{n} - \text{Min}(M) \right) \times \frac{\text{Max}(MA)}{\text{Min}(M)} \right] \dots\dots\dots \text{Equation (1)}$$

IAR: Intelligent Absent Rate

Min (A): Minimum absent that allows for each student is %5.

Min (M): Minimum mark for pass is %50.

Max (MA): maximum absent rate when student can add through activities (% 20).

Xi: the criteria like GPA, Marks, and activities

For example, one of our students has a higher attendance rate than the standard, 15 per cent which i mentioned. That is, the percentage of attendance to be present is 16 per cent. This means that these students will be failing according to university standards, but will be based on current GPA, new GPA, Activity-class and the equations i are referring to, there seems to be more opportunity to continue in the course. As shown in Table 2.

Table 2. Intelligent Attendance System

	Name	Code	No.	Student	Courses	GPA	Marks	Activities	Absent
1	Student1	A1232	%99	%99	%99				24.6
2	Student2	A1232	%75	%75	%75				15
3	Student2	SE235	%50	%50	%50				5
4	Student3	A1232	%100	%100	%100				25
5	Student3	SE235	%50	%50	%50				5
6	Student4	A1232	%50	%60	%50				6.33
7	Student4	SE235	%70	%60	%50				9
8	Student4	OS261	%100	%80	%50				15.66
9	Student5	A1232	%90	%50	%50				10.3
10	Student5	SE235	%80	%50	%70				11.66

To further clarify these actions, i will discuss and analyze some of these examples in this study to understand more. About the use of this new equation that i have identified to find out more about how i can solve student absentee statistics, i recommend that he/she continue to study in that course if you have exceeded the amount of the Central Teaching Act.

Let's take a look at the first-row sample to find out the analysis of the equations that i have defined. How many collaborators are there to come up with the right results?

Here's an example of a student taking a course with an (A1232) course code that has a high GPA (99), Mark (99) and daily activities (99). Likewise, i will use these grades in

Equation (1) to determine how long this student will be allowed to absent in this course.

For first row: Student No.1 course code (A1232)

$$IAR = 5 + \left[\left(\left(\frac{50 + 50 + 50}{3} \right) - 50 \right) * \frac{20}{50} \right]$$
$$IAR = 0 + 5 = 5$$

If i pay attention here, the second Student No.2 in the (A1232) course code will have a Mark, GPA and Activities grade in the middle grade. Therefore, he or she can be absent to the extent specified i mentioned in the Central Teaching Act standard (15) hours.

For third row: Student No.2 course (SE235)

$$IAR = 5 + \left[\left(\left(\frac{75 + 75 + 75}{3} \right) - 50 \right) * \frac{20}{50} \right]$$
$$IAR = 10 + 5 = 15$$

If i pay attention here, the second Student No.2 in the (A1232) course code will have a Mark, GPA and Activities grade in the middle grade. Therefore, he or she can be absent to the extent specified i mentioned in the Central Teaching Act standard (15) hours.

For third row: Student No.2 course (SE235)

$$IAR = 5 + \left[\left(\left(\frac{99 + 99 + 99}{3} \right) - 50 \right) * \frac{20}{50} \right]$$
$$IAR = \frac{123}{5} = 24.6$$

starts at the top of the 75 score, allows these students to be absent for up to 25 hours, meaning that students have a high level of knowledge.

Here i have the same Student No.2 but a different course (SE235). On the other hand, this student has a low GPA, Mark and Activities scores so he can be absent for (5) hours. Finally, i can say the same for all courses and students in the same way.

Implementation

In this section, i present the implementation of the new ANN for attendance system using Matlab software. In the Fig.3 the result of our model illustrated, based on the graph with increasing mean of activities that are (GPA, Marks, and Activities) the rate of absent increased, the minimum activities is %50 the absent rate is %5, when the mean of activities increased the rate of absent will be increased, when the maximum amount of absent rate is %25 when the mean of activities like (GPA, Marks, and Activities) become too %100.

Also, this absent rate presented by Matlab graph in Fig4, this figure shows that straight line and the students who failed to succeed are pointed out by the red line. In common, this means

that all their scores in GPA, Marks and Activities are below 50. But, the students who are able to achieve the success rate are determined by the average grade, which means that it starts from 50 until 75 as mentioned by the blue line. As well as the amount of absenteeism is determined from 5 to 15 hours. The red line, which

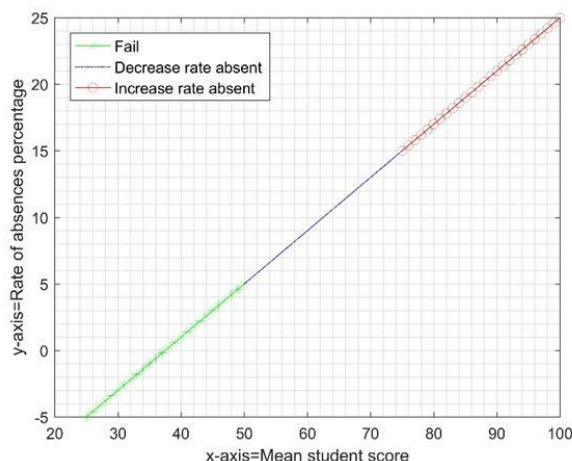


Fig.3: Intelligent attendance system per course

The Matlab Code for Fig.4 presented below:

```
x0= 25:50;  
x1 = 50 : 75;  
x2 = 75: 100;  
y0= -5:0.4:5;  
y1 = 5:0.4:15;  
y2 = 15: 0.4 :25;  
plot(x0, y0,'-*g')  
hold on  
plot(x1,y1,'-.b')  
hold on  
plot(x2,y2,'-ro')  
xlabel('x-axis=Mean student score');  
ylabel('y-axis=Rate of absences percentage');  
grid on  
grid minor  
legend({'Fail', 'Decrease rate absent', 'Increase rate absent'},'FontSize',10,'Location','NW')
```

Evaluation Intelligent Attendance System

The intelligent absent system more efficient compare with classic attendance system, this system consists of three cases. The first case gives 5% of rate absent even student ignore activities and get loist marks, this rate increased with increasing mean of activities, in this case, students that have low activities must be taken more attendance and provide more learning for students. The second case when the mean of activities 75% of students takes 15% like the classical system, this case allows the student to get the normal absent rate. In the third case, student can take an extra 10% when activities become to 100%, this case allows to smart students to take low attendance with high marks. Finally, i can say this system very smart and increase the efficiency of learning.

Conclusion and Future work

In this paper, i proposed an intelligent approach for calculating student attendance based on their Grade Point Average (GPA) and their activities, this approach uses Artificial Neural Network (ANN) for calculating the attendance rating accurately, meaning the system provide a new rating for each student based on their background. The result of this approach helps the instructor to allow students who have more activities with more absents to continue in the courses if not the students have low activity should taking high attendance. This system will more efficient for monitoring students for replacing absent to activity compare with the classic system because students can take an extra 10% absent rate when he completed all activities. i recommend to researcher improve this system through different techniques like data mining conventional neural network, moreover mixed with fingerprint and any image processing techniques to present accurate and high result.

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