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An Effective Technique to improve slow learner in adaptive e-learning based on Marzano's Taxonomy with Machine learning algorithms

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Abstract

The proposed work is to monitor the performance of the learner. Consider the learner are not ready to learn the document in terms of text or document oriented , then these types of learner determined as slow learner. If the user view the appropriate document. They are termed to active learner. The proposed system can easily construct adaptive subject series of tests and propose sources for the learners to study and tutors to talk to, by taking both student learning behaviors and learning styles as part of the personalization information. This proposed machine learning algorithm will determine the slow learner and using decision tree algorithm, appropriate content in terms of video or audio will be uploaded dynamically to improve the performance of the slow learner. These proposed works provide efficient and effective methods using machine learning algorithm for knowledge extraction using adaptive learning.

Keyword: Marzano's Taxonomy, Machine Learning Algorithm, Adaptive E-learning System

1. Introduction

E-learning is seen to supply versatile and innovative ways in which of supporting and enabling quality learning and teaching. E-learning is outlined because the general use of networked, transmission laptop technologies to boost learning; empower learners; connect learners to individuals and resources corroboratory of their needs; integrate learning with performance and link people with structure goals. Distance education is actually a chance for those that haven't any time to continue their education in the traditional mode, attending categories frequently, thanks to some reasons. A number of the disadvantages of distance education that doesn't embody direct provision of standard interaction between a student and a lecturer, no doubt of revision, so on may be resolved by using adaptive e-learning.

Adaptive e-learning combines the previous generations of rule-based, mechanical device learning, and deep learning approaches to machine intelligence. Human analyst's area unit optimally

engaged in creating the machine intelligence smarter, faster, and easier to interpret, building on a network of the previous generations of machine intelligence based on Marzano Taxonomy.

Marzano New Taxonomy is formed of three systems and therefore the cognitive content, all of that square measure vital for thinking and learning. The three systems square measure the Self-System, the Metacognitive System, and therefore the psychological feature System. Once moon-faced with the choice of beginning a brand new task, the Self-System decides whether or not to continue the present behavior or have interaction within the new activity; the Metacognitive System sets goals and keeps track of however well they're being achieved; the psychological feature System processes all the required info, and therefore the cognitive content provides the content.

2. Literature Survey

Silvi Octaviani Asmi et.al(2019) This study aims to see variations in psychological feature learning outcomes and self-systems supported the marzano taxonomy student's UN agency square measure tutored with a retardant based learning model assisted by amalgamated learning on the fabric of atomic spectroscopy. This study uses psychological feature information take a look at instruments that have content validation of 90.17% with very good criteria and Alpha Cronbach reliability coefficient of 0.634 in the high category. The research sample was conducted in two research classes at Malang State University.

Andres Villanueva Manjarres et.al. (2018) illustrates that educational data processing is AN rising discipline that seeks to develop strategies to explore massive amounts of knowledge from instructional settings, so as to grasp students' behavior, interests and ends up in a more robust method. In recent years there are varied works associated with this specialty and multiple data processing techniques derived from this to address completely different instructional issues are used. The aim of this proposed work is to gift a review of the works within which data processing techniques were wont to solve specific issues of education and to try and do a classification associated to numerous eventualities within which they need been applied.

S.Sreeja et.al. (2017) explained, data mining is a necessary idea to retrieve the correct information with the assistance of correct queries associated with info setting. The methodology |of knowledge mining separates the retrieval information and irrecoverable data supported user needs. The secure E-Learning could be a platform provides the just-in-time learning it fulfills the necessities of learners.

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3. Proposed Work

Today, people are living in the cyber world, where the user can extract any information through the cyber world. Even School students or college students or even research scholars can learn their subject with their own interest. This proposed work are classified by three types of user such as i) E-Learner ii) Tutor as show in Figure 3.1

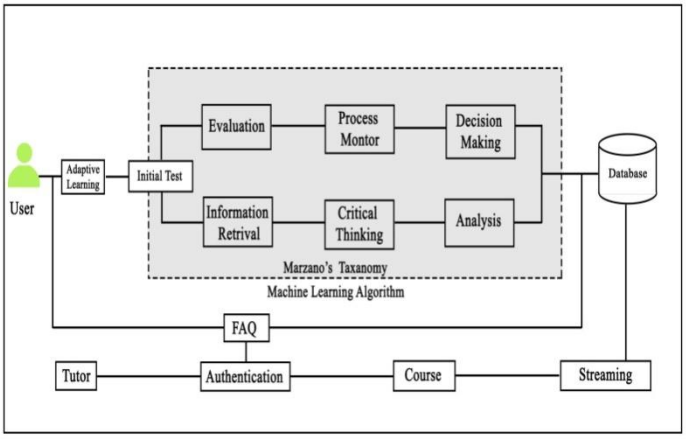

Figure 3.1: Description of the proposed work

E-learner who can learn any type of subject through proposed web server, where the user are authenticated before they start learning. These e-learn can learn their course based on their own interest. While learning they can ask any types of queries, which are updated in the web server, appropriate tutor will responds to the query generated by the e-learn. Once the e-learner completed their course, they can take their test. These test are monitored by the machine learning algorithm.

These proposed algorithms mainly focused on new Marzano Taxonomy principles which are classified into six levels to improve the performance of slow learners. Marzano taxonomy consist of six level. From the bottom to top level of New Marzano taxonomy are as follows.

- Level 6 focused on self-system thinking which is used to evaluate the performance of the e-learner during learning the course with the help of streaming server.
- Level 5 focused on specify goal which is to determine the performance of the e-learner. If the e-learner are active they are consider to active listener. If the learner are not ready to read the content in terms of text, they are considered to passive listener and same content are provide in terms of other media. Performance of the active listener and passive listener are monitored.
- Level 4 focused on knowledge utilization which is used to determine, what kind of content to be delivered by slow learner. Which type of medium had to provide for the slow learner will be determined based on the performance of the slow learner.

- Level 3 focused on Analysis part which will determine the appropriate media content to improve the performance of the slow learner.
- Level 2 focused on comprehension which determined the critical thinking about the material requested for the active learner and slow learner.
- Level 1 focused on Retrieval information which determined the appropriate data viewed by the active learner and also by the slow learner.

The above six levels are determined by the new taxonomy of Marzano.

The Next phase of the proposed work , tutor who act as administrator. Once these tutor are authenticated, these tutor will respond to both active learner and passive learner in terms of slow learner. When the document skipped by the passive learner, they are termed as slow learner. Tutor will had to respond to the FAQ generated by any type of learner.

4. Architecture

In learning the impact of adaptive learning in science courses, most researchers typically listen to the impact of one variety of personalization, like learning performance (including learner's profile and learning portfolio), learning vogue, and psychological feature kind of individual students, on the determination of issue levels, learning ways or presentation sorts of subject materials.

The study of how learners learn has been a concern for researchers for many years. In traditional classroom system, an instructor can control this aspect based on what s/he sees of her/his learners' reaction. However, for e-learning to be effective, it ought to be custom-made to one's personal learning vogue. Traditional e-learning systems provide the same materials to all learners. E-learning systems ought to be capable of adapting the content of courses to the individual characteristics of learners.

The process of adaptive e-learning mainly focused into three phases such as User profile, marzano taxonomy, machine learning algorithms and tutor as shown in Figure 4.1.1.

User Profile: mainly focused on the person who learn their technology or subject based on their interest through cyber world. These people are categories into three level as shown in the figure.

a) Active Learner: The Student or the candidate who is very active in learning their technologies with interest termed as Active Learner.
b) Passive Learner: The Student or the candidate who is comparatively less active in learning their technologies through online mode.

c) Slow Learner: The Student or the candidate who had interest in register their course and not involved in learning the courses or the technology termed as slow learner.

These are the types of the learner who played a major role in the proposed work.

Marzano Taxonomy: is the process of extracting the knowledge form the appropriate documents with various as follows.

- The first four levels of processing are cognitive, beginning with "Retrieval" the least complex, then moving upward with increasing complexity through "Comprehension", "Analysis" and ***"Knowledge Utilization".***
- The fifth level of processing, the ***Meta-Cognitive System***, involves the learner's specification of learning goals, monitoring of the learner's own process, clarity and accuracy of learning. Simply put involves the learner's organization of their own learning.
- The sixth level of processing, the ***Self-System***, involves the learner's examination of the Importance of the learning task and their self-efficacy. It also involves the learner's emotional response to the learning task and their motivation regarding it.

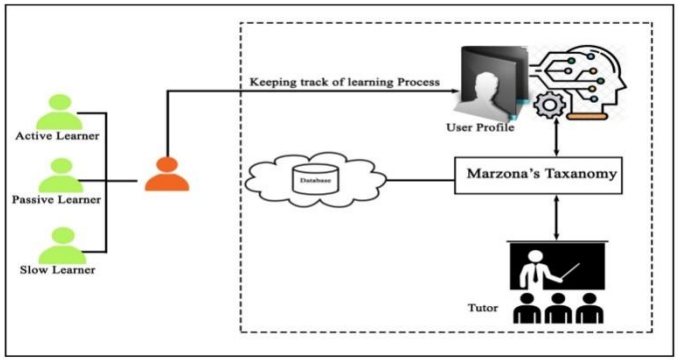

Figure 4.1 Architecture of Adaptive E-Learning system

Machine learning Algorithms: This Machine learning algorithm mainly used to analysis the user belongs to which category based on K-NN Algorithm. Clustering the user mainly focused on K-NN Algorithm. Three different types of the user are classified as follows.

- If the user is very active by click the appropriate link and spending more time in learning and also the submission of assessment in time leads to active learning along with user interaction.
- If the user is click the appropriate link and spending time less compare to the active user and also the submission of assessment in average time then these types of user are classified as passive learner

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- If the user is very slow in learning the document, just registered and lack of interaction with subject and cannot able to understand and submit the assessment, they are termed as slow learner.

Tutor: The next level of the candidates is the tutor, who is responsible for particular subject. The tutor will upload the same subjects in terms of audio, video, graphics and animation with streaming server and also encrypted using Elliptical curve cryptography. These are the process of Adaptive E-learning system.

5. Proposed Algorithm

Algorithm are mainly classified into two categories such as decision tree and

Decision tree algorithm adopts a model to

- Create a tree structure from the given data set where each node represents attributes test or conditions and final leaf node represents the test results or classes.
- The constructions of decision tree are done by divide and conquer recursive method.
- The attribute used here should be of categorical and if it is of continuous values then it had to be converted to discrete values before starting the process.
- Initially all samples are on the single root node and then the remaining nodes are created based on the attribute partitioning condition.
- This is a recursive process and it stops with the following conditions to be true.

5.3.1 Algorithm

The proposed algorithms to determine in degree of each and every particular node in terms of candidates are as follows.

Step 1: Let n be the number of candidate who take part in e-learning the course in the internet world.

Step 2: Let C be the set of Candidates who learn the course with adaptive e-learning system. Candidate can be student of school or college or any training institute etc.,

Step 3: Assume that C_1 to C_i be the Candidate list who learn the appropriate courses such that for all i = 1 to n number of candidates .

Step 4:Construct a directed acyclic graph (DAG) such that each student had discussion with other student for the candidate relationship C_1 to C_i such that

- If there is a discussion between from C_i to C_j
  then assume C_{ij}=1 indegree →1
- If there is no discussion between Ci to Cj

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Then assume C_{ij}=0 indegree →2

- If there is relation between Ci to Cj for i =j

  Then assume C_{ij}='*' indegree →3

Step 5:After estimation of indegree, Construct a table with appropriate indegree for all candidate C_i such that assign all the indegree for each and every Candiate.

Step 6:Assume AL ← Active Learner ← 0

SM← Star Performer ← 0

SL← Slow Learner ←0

Step 7:Calculate the total number of AL,SM, SL such that

If(Ci>0) then AL=AL+1; →4

If(Ci<=0) then SL=SL+1; →5

Step 8:To determine the Star Performer Big←0

Step 9:foreach(candidate indegree in the set){

If(C_i>big){

Big=C_i;

}}

Step 10:SM=big;

Step 11:Display AL;

Step 12:Display SL;

Step 13:Display SM;

Step 14: Stop the Process

6. Experimental Result

Consider there are 15 Student who are registered the course through adaptive e-learning system. Construct a directed acyclic graph for the 15 candidates which are describes as shown in figure 6.1. Assume that P1,P2,… P24 are representing person who registered and learning the adaptive e-learning system. From the following the directed acyclic graph, construct transitive closure table such that both vertical and horizontal displayed with P1,P2,.. P24 both horizontally and vertically in two dimension matrix format.

If P1 discuss with P2 on subject basis, then there is directed line drawn from P1 to P2. Such way complete the entire directed acyclic graph for the person from P1, P2… P24.

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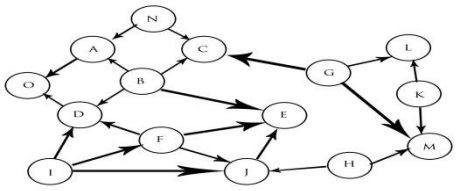

Figure 6.1 Construction of DAG for Sample data

From the figure, Convert the diagrammatically representation to transitive closure table with two dimension format with the following rule

- If there is discussion form Pi to Pj then the value will be 1 between Pi to Pj for all 1 to 15 .
- If there is no discussion from Pi to Pj then the value will be 0 between Pi to Pj for all 1 to 15.
- There is no discussion from Pi to Pj if the value of i and j are equal then the value of the matrix is "*"

Based on the above rule, the following table had been constructed as shown in table 6.1

	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
a	*	*	*	*	*	*	*	*	*	*	*	*	*	*	1
b	1	*	1	1	1	*	*	*	*	*	*	*	*	*	*
c	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
d	*	*	*	*	*	*	*	*	*	*	*	*	*	*	1
e	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
f	*	*	*	1	1	*	*	*	*	1	*	*	*	*	*
g	*	*	1	*	*	*	*	*	*	*	*	1	1	*	*
h	*	*	*	*	*	*	*	*	*	1	*	*	1	*	*
i	*	*	*	1	*	1	*	*	*	1	*	*	*	*	*
j	*	*	*	*	1	*	*	*	*	*	*	*	*	*	*
k	*	*	*	*	*	*	*	*	*	*	*	1	1	*	*
l	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
m	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
n	1	*	1	*	*	*	*	*	*	*	*	*	*	*	*
o	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	2	**0**	**3**	**3**	**3**	**1**	**0**	**0**	**0**	**3**	**0**	**2**	**3**	**0**	**2**

Table 6.1 Construction Candidate involvement table

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From the above table, constructed to determine the number of active learner, slow learner and smart learner by implementing the proposed algorithm by the following table used to determine the active learner, slow learner and smart performer for the active e-learning adaptive system as follows.

a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
3	0	5	4	4	2	0	0	0	5	0	4	6	0	2

Table 6.2 Calculation of IN degree

From the table of 6.2, can be determined the total number of active learner, slow learner, smart performer as shown from the **table 6.3.**

TOTAL NUMBER OF STUDENTS=15		
INDEG(U)	CATEGORY	COUNT
MAXIMUM	STAR PERFORMER	1
">=1"	ACTIVE LEARNER	8
"=0"	SLOW LEARNER	6

Table 6.3: Classification of Learner

From the table 6.3 can determined that number of active learner, slow learner and smart performer.

By implementing the proposed algorithm, machine algorithm will provide documentation in terms of video, audio, graphics and animation to improve the slow learner into active learner based on their involvement in studies as shown 6.4

TOTAL NUMBER OF STUDENTS=15		
INDEG(U)	CATEGORY	COUNT
MAXIMUM	SMART PERFORMER	1
">=1"	ACTIVE LEARNER	10
"=0"	SLOW LEARNER	4

Table 6.4 Proposed Algorithms.

From the table 6.3 and 6.4, compare the existing and proposed algorithm are shown form the table 6.5

TOTAL NUMBER OF STUDENTS=15			
INDEG(U)	CATEGORY	Existing(Count)	Proposed(Count)
MAXIMUM	SMART PERFORMER	1	1
">=1"	ACTIVE LEARNER	8	10

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"=0"	SLOW LEARNER	6	4

Table 6.5 Comparison

From the table 6.5 conclude that proposed algorithm provide an efficiency compare to existing system.

7. Evaluation Performance

To determine the number of active user, smart performer and slow learner compared with existing and proposed system as shown in Figure 7.1

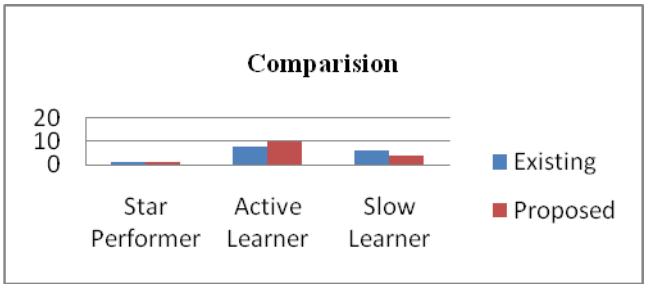

Figure 7.1 Comparison with existing and proposed

From the graph 7.1 determine that number of slow learner performance are improved.

8. Conclusion

These proposed works conclude that proposed algorithm improve the efficiency of the slow learner by providing appropriate document. These improve the strategies of the slow learner in the cyber world. The strategies used by the machine learning algorithm will effectively improve the performance of slow learner. An Intelligent System Based E-Learning model has been proposed to categorize learner characteristics for appropriate selection of course contents for appropriate learner characteristics. The benchmark value of selected learner categories for this model has been obtained through social survey. It is very clearly demonstrated that a distinct demarcation between Active Learners, Slow Learners and Passive Learners care categorised who can be quantified and measured.

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