Classification model development for performance analysis of LMSUsing Machine Learning Algorithm and Blockchain Framework

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Abstract:
The education system grows faster with cutting-edge technologies like artificial intelligence and blockchain execution. Traditionally, learning management systems were limited to online education, where mentors and students were limited to interaction based on study materials. However, due to the Covid-19 pandemic, the need for end-to-end system solutions rose. Some of the current requirements are virtual classrooms, session- based analysis, and prediction systems. Hence, this paper presents an analysis of the usability of the blockchain framework, which can improve the classification of data performance using machine learning algorithms. The proposed framework analyzes health science students' and mentors' performance based on class, subjects, grades, and mentor attentiveness.

Keywords: Blockchain, LMS, machine learning, linear regression, online learning, virtual tutor

1. Introduction

The E-learning System for Learning 4.0 goal is to computerize the known manual platform with the help of digital tools and undeniable development, satisfying their preferences so their essential data can be recorded for a much longer time with convenient entry point and regulation of anything equivalent [1]. Blockchain is a distributed model that bonds data structure for documents storage, making sure the data is resilient to alteration and tampering [10]. Primarily, blockchain functions were primarily delimited to cryptocurrencies as well as monetary transactions. On the other hand, with the design of smart contracts, blockchain concept has exposed up an array of unique tasks [2].On-line learning has broadened significantly at the time of the past couple decades. According to the, E-learning/online learning proceeds to have the quickest development in the sector, with an typical gross annual development rate of 20%. By 2027, it is forecasted that the industry for mobile learning will be valued $80.1 billion all over the
world [3].

Nevertheless educators are motivated to implement concept to boost the learning approach, their emotion about applying technology in educational evaluation is still unidentified [4].Distant labs have been designed at many universities and colleges globally to offer learners with access to equipment and tests via the Internet round the clock, thus offering partner organizations the prospect to reveal resources, costly tools and particular labs, whether among a solitary nation or at territorial and overseas levels. Universities and colleges usually execute learning management systems (LMS) such as Moodle and Blackboard to allow students to communicate, execute learning activities and access remote labs [5]. The overview of LMS is shown in Fig.1.
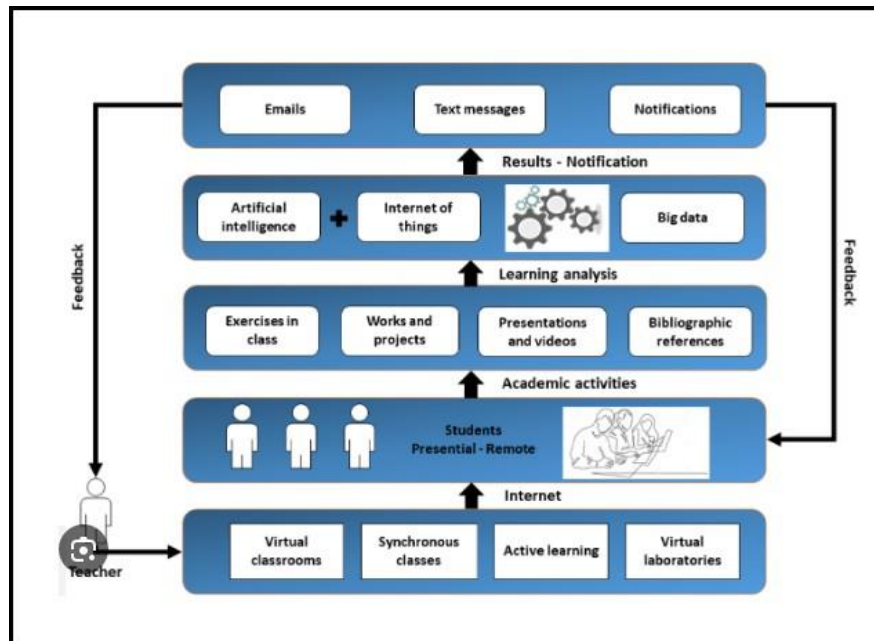
6265

Fig.1: Learning Management System Overview (Source: William Villegas-Ch et al, 2021)

Presently there are various uses of "distributed ledger technology" that can be observed at this time. They are pertaining to multiple program fields and are tailored to frequently very distinct information systems. In the educational field, universities and colleges were the primary end users of the blockchain to conveniently organize and restrain universal procedures, establishing it to their systems [6]. The introduction of blockchain technology through the previous decade has led to the advancement of allot more use-cases of decentralization in numerous areas incorporating education. This study reveals an exclusive bibliometric and qualitative evaluation of the blockchain in education with new additions on provisory development, surfacing topics and useful case studies on usage and incorporation with well-known educational solutions [7].

2. Literature Review

In education, blockchain tasks have been researched in many factors including certificate/degree confirmation and annulment, user-centric informational track record supervision, students' professional potential analysis, blockchain founded educational organization systems, as well as , on-line learning conditions [8]. In the arena of higher education level, security and certainty breaches are allegedly raising annually, specifically in relation to educational diplomas and degrees. Blockchain technology, offers a function in guaranteeing their genuineness and managing appropriate records. The raising digitization of higher certification has additionally contributed to the recommendation of issues interrelated to assured storage, even though blockchain concept permits decentralized clear data, absence of scams, secure storage of data, and decrease in transaction expenditures associated with educational data regulation [9].

Smart E-Learning is an studies type, through which information technology performs an essential part. Smart E-Learning incorporates the accomplishments of cutting-edge systems just like artificial intelligence (AI). Consequently, it can support to earn the capability of interaction, sharing, ease, and versatility for students. All activities incorporating educating, learning, discussing, screening, and grading, are well carried out through the internet ecosystem. On the other hand, several likely challenges can trigger individuals, specifically, regarding data security. The concern is a gigantic issue for developing applications for smart E-Learning [10].

The interruption of organizations all across the world in early 2020 because of the COVID-19 virus did not

6266

prevent the learning progression. E-learning principles as well as ,digital systems allow learners to study from a secure distance even though carrying on their educational activities. Presently, the Internet of Things (IoT) is among the most swiftly raising systems in today's online globe; and e-learning is among the very effective learning strategies obtainable. In today's environment, smart devices as well as , new systems help instructors in focusing on new versions of learner learning whilst averting time wastage [11].

Currently the Edublocs project is tailored and executed, which blend components of peer-to-peer learning as well as ,the educating staff. The goal of the Edublocs project is to ease the procedure of planning and employing a program for recording process outcomes with the aid of blockchain technology. This continual project is in the procedure of analysis. The experimental execution in the view of higher education permits us to additionally reveal the durability and significance of the program of blockchain technology in education [12]. The educating learning procedure desires to be recognized regarding different variables: modification in procedure, change in players, transformation in results produced, and many. The linked difficulties shall also be determined. A thorough evaluation of such permits us to determine that these kinds of technologies, can reform the teaching sphere for better in future, specifically Blockchain is new, however , outstanding to the gains produced from it, farther analysis and usage shall for definitely modify the teaching-learning procedure [13].

In this study, author recommended a predictive model that evaluates the challenges encountered by at-risk learners, eventually, assisting teachers for regular involvement to encourage learners to maximize their study events and strengthen their study efficiency. The predictive model is trained and tested employing various machine learning (ML) and deep learning (DL) algorithms to define the learning patterns of learners relating to their study parameters [14]. Author used machine learning to develop models for the early on auguration of students' capabilities in resolving LMS tasks, by means of merely inspecting the LMS log files produced to the instant of prediction. Additionally, this models are program agnostic, since the datasets are developed with all the University of Oviedo programs for a single educational year. Decision tree, na¨ıve Bayes, multilayer perceptron (MLP) neural network, as well as support vector machine models are designed and examined. [15]. This study reveals a strategy to predict at-risk learners in the circumstance of a program aided by an LMS. LMSs deliver significant amounts of data regarding programs and learners, which inturn enable institutions to produce beneficial information by using computational analytic tools. Most institutions state that the mainly vital concern in digital learning is large student dropout levels, and institution performance is the key elements [16].

3. Research Methodology

A blockchain structure is basically the procedure of mechanizing the decision-making procedure recorded in the distributed ledger that completes regular attributes on campus. For case in point, AWS has various predetermined blockchain layouts to support purchase administration, and these kinds of layouts will enhance aspects including admission processing, assemblage decision-making, degree pathway refinement, and help- desk support tasks. The entire LMS contains many modules like student enrollment and validation process for admission, selection of customized course syllabus, assigning tutor, flexible class time frame selection, and progress report of student followed by result analysis with certification. The proposed research focuses on the data acquisition on two fronts: first the student side and other is institutional data processing. On two fronts blockchain need to be synchronized using machine learning classifier. Following Fig.2 shows the test template blockchain module with machine learning classifier.
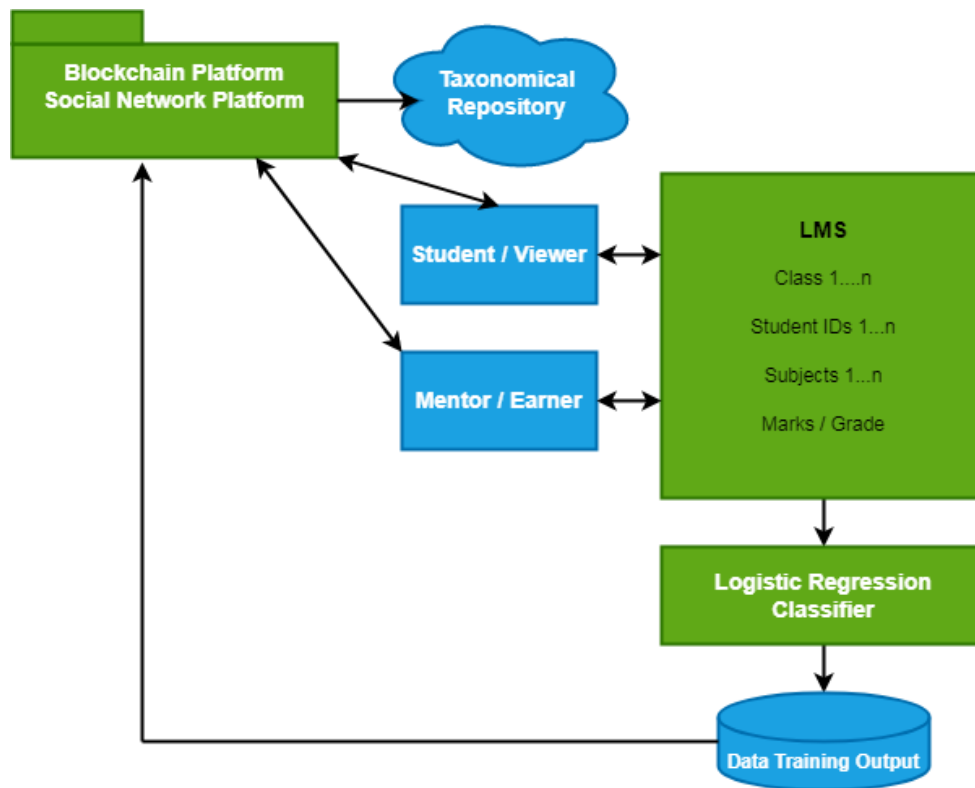
Fig. 2: Proposed framework

Classification is the method of discerning, realizing, and grouping strategies and targets into pre-specified groups or "sub-populations." Applying pre-categorized training datasets, machine learning applications employ a range of algorithms to sort out upcoming datasets into groups. Logistic regression is a computation utilized to forecast a binary outcome.

Independent parameters are reviewed to identify the binary result with the outcomes becoming into one of two groups. The independent parameters deemed as number values, and as the dependent parameters are often specific which in proposed case deemed as a subject for which students are appeared.

$$\text{P}\,(S_{subject}=1|S_{marks})\,\text{or}\,\text{P}(S_{subject}=0|S_{marks}) \text{ ---}(1)$$

It calculates the probability of dependent parameter $S_{subject}$, given independent parameter $S_{subject}$. This can be used to calculate the probability having a positive or negative connotation.

The classification is conducted on 'xAPI-Edu-Data' dataset containing 300 samples of health science students. The reliability test is conducted for known 30 samples of students who used LMS system. The dataset training and validation conducted and results discussed in the next section.

4. Result and Analysis

The classification is executed using proposed framework where each block is accessible to every sample. The logistic regression used recurrently to analyze each block entry by students and mentor. The reliability nodes are shown in Fig.3.
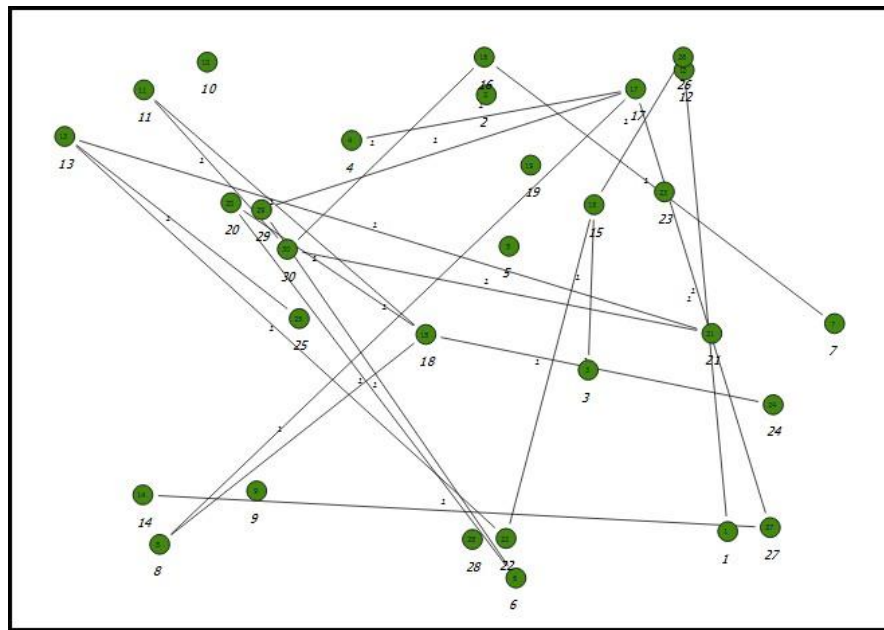
Fig.3: Reliability test nodes (N=30)

Further, the blockchain using machine learning algorithm is tested for classification based on the inter-block assessment. For example, node-11 is accessing multiple blocks data as shown in Fig.4.
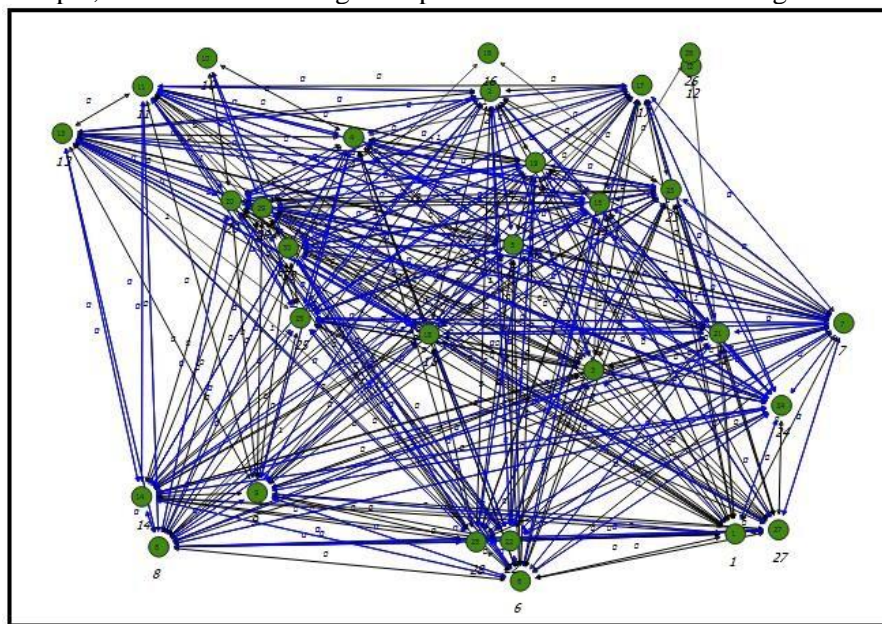

Fig.4: Inter-block assessment of nodes

The output of classification of every node based on performance is shown in Fig.5. Active blocks are shown as a radial plane (Red color).
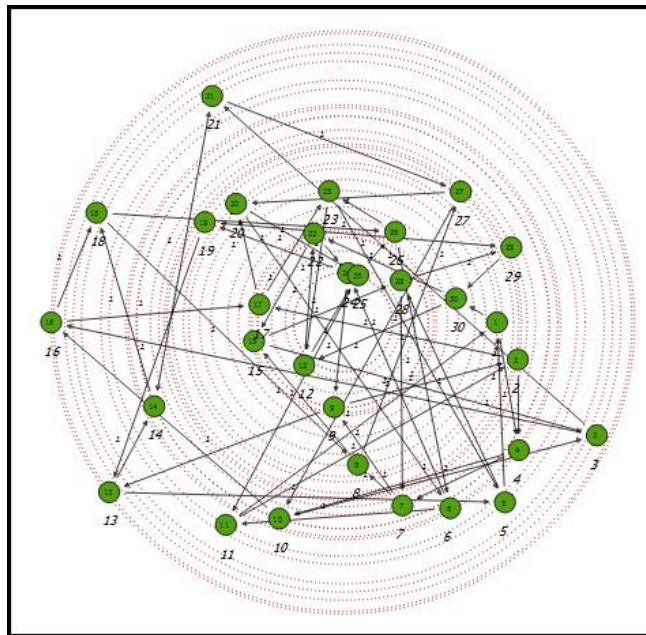
Fig.5: Active block information sharing and classification of dataset

The calculated correlation matrix for four students and mentor interaction who'r using LMS-blockchain system is shown in Table 1, where student and mentor are actors.

Table 1: Calculated Correlation Matrix

Actor/Actor	1	2	3	4
1	0.000	1.414	2.000	1.732
2	1.414	0.000	2.000	1.732
3	2.000	2.000	0.000	2.000
4	1.732	1.732	2.000	0.000

Similarly, the information centrality for classification based on social network portal access to LMS is shown in Table 2.

Table 2: Calculated Information Centrality

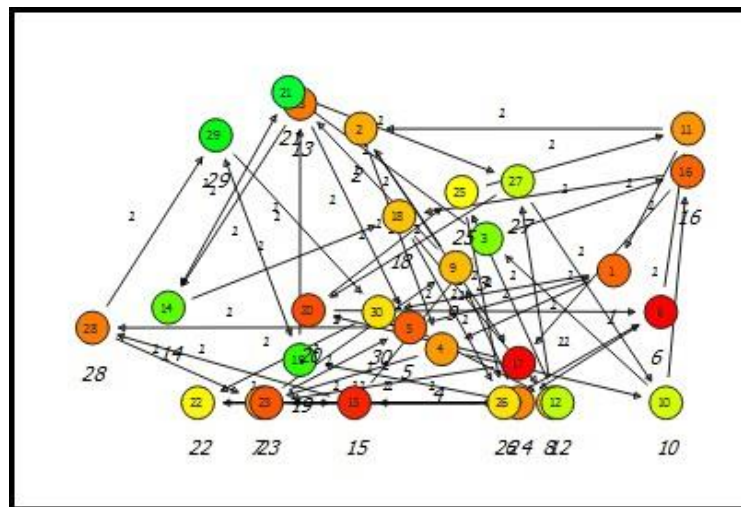| Actor/Actor	1	2	3	4
1	1.000	0.929	0.857	0.893
2	0.929	1.000	0.857	0.893
3	0.857	0.857	1.000	0.857
4	0.893	0.893	0.857	1.000

Fig.6: Overall Grade wise classification of LMS

As shown in Fig.6 above, the proposed system gives the recurrent grade evaluation for students. Here, low (red), medium (orange), average (yellow) and higher (green) grades are classified and represented. The evaluator mentor nodes are also shown (lime-green) which are considered as a moderator blocks.

5. Conclusion

The proposed study provided the significance of the blockchain for enhancement in learning management system performance. Linear regression algorithm can interact in the iterative way with each block of blockchain to record and classify the parameters like class, subject and grades. It is presented from correlation matrix that both the entities/actors i.e. student and mentor can get the access to any block during the session even via social network portals. The classification can be fast using blockchain which can improve result oriented analysis. The stored outcome can be used for future research for prediction of performance of student and mentor.

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