Enhancement of Ontology e-learning through Machine Learning Techniques

Yaratha Nikhil Vardhan Reddy

FIITJEE School

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ABSTRACT

E-learning is a method of providing students with access to information via computers, tablets, and smartphones. Essentially, e-learning takes place online, giving students access to their course materials whenever and whenever they choose. The objectives of the machine learning approach presented in this research are to assist knowledge improvement by providing personalised and dynamic learning experiences. It matters while considering knowledge that is easily accessible. The study of ontology focusses on the nature of authenticity and reality, as well as what is real or truth. The ontology technique is used to illustrate one's knowledge in particular fields. E-learning ontology can be used to describe vibrant knowledge and to represent domains in the educational domains. This study consolidates ontological advancement and offers a balanced approach to addressing an educational model. Determining the ontology's domain and scope, taking into account reprocessing the current ontology, and listing important concepts are the subsequent procedures that have been modified for ontology progression. The lack of control over data design in the educational domain through e-Learning performances is one of the primary problems. Building modelling facilitates communication between the e-learning system's behaviour and structure. When paired with domain knowledge, e-learning ontology can construct a semantic model of the data. The suggested disclosure technique for enhancing e-learning ontologies using machine learning has been genuinely tested in an e-learning setting to demonstrate database management systems. The student will choose his subjects under this proposed system, and he will then take the test for that subject. After seeing his marks, the system will ask the student if he needs any videos or PDFs for his feedback form. Based on his performance prediction, the system will then display the relevant videos or PDFs. This paper's major goal is to cluster students using the KNN, SVM, and K-Means algorithms. It also makes use of the ontology concept of understanding and learning style recognition.

INTRODUCTION

The phrase "e-learning" was first and principally coined in the year by Computer Based Training (CBT). E-learning frameworks have flourished in real insight over the last twenty years. Another strategy to help students become more capable of improving their vision is to provide them with an edification framework in an online environment. Either way, students are no longer capable due to the vast amount of e-learning material and the various completion schedules. and to finish all necessary learning materials in the allotted time. This incentivises people to look for flexible methods with personalised content. The suggested e-learning ontology is a framework that is shown to address the problem of methodological learning in a way that is comparable to the delivery of static and generally beneficial materials to all students, as well as the delivery of flexible and updated content.

The e-learning framework adapts the learning process based on the experience information and current level of knowledge of the students. One of the main issues with developing a state-of-the-art eLearning system is online learning. Some types of pupils need specific types of learning tools (in different formats, such as texts and recordings) in order to acquire concepts more effectively. Each student possesses unique knowledge and skills. This affects how electronic learning (eLearning) frameworks identify each advancement's profile and select information that regularly satisfies their needs. It depends on model which characterizes all facts about learners and is assembled progressively

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by the framework using a few information sources (for example pupils enrolment structure, information from connection with framework, teacher).

The information obtained is divided into two groups: unchanging: This is the entirety of a learner's attributes that remain constant over the course of a learning cycle (name, capabilities, etc.). The dynamic that compiles information about the student's current course demo and displays the student's knowledge and skills is crucial for the current courses. The customised model is based on all of the data. [Gomes and others, 2005]. The online approach enables content developers to modify course content based on information that has been evaluated (using information mining tools) from learner interactions with the framework. The purpose of educational programs is to empower students for the future by helping them develop their abilities and move forward rationally to address challenges in the real world and succeed both academically and professionally. Within the normal tutorial room learning framework, teachers teach the same content to every student without taking into account the character, behaviour, or learning style of each student, their degree of anxiety, their intellectual preferences, or the impact of previous grades. Such present learning is not based on powerful programming-based learning, but rather on static knowledge over learning materials. If students in this type of framework want to improve their learning outcomes, it is up to them to make the necessary adjustments based on the course material. Ontologies are used to facilitate semantic search and knowledge exchange, allowing for the assessment of different sources and the identification of relationships between learning objects that are not strictly reasonable.

This work includes techniques and protocols to assist a local authority in presenting educational spaces by administering useful educational ontologies, particularly e-learning ontologies, and exploiting them to perform and characterise customised e-Learning encounters within mixed learning environments. Expanding knowledge reuse is aided by shared ontologies.

In this proposed Enhancement of e-learning ontology using machine learning approach, learners is going to select his subjects based on that subject learner should take the test of that particular subject then by seeing his obtained marks in that subject its asks whether he needs pdf's or video in his feedback form then by predicting his performance it shows the particular videos or pdf's K means, support vector machines, and KNN algorithms are examples of machine learning techniques that are used. In this case, K stands for mean, KNN primarily for classification, and SVM for student performance prediction. Using the student marks proposed method, which is based on the subjects they have taken, certain videos and PDFs are recommended.

Students are required to complete the feedback form following each exam so that the platform may determine whether or not the students are benefiting from it.

PROPOSED METHODOLOGY

Student datasets are gathered for this project at https://www.kaggle.com/marlonferrari/elearning-studentreactions. Three methods are employed in this system: support vector machine, KNN, and K-means. Support vector is used for prediction, while KNN and K-means are used for classification. The necessary advice will be given based on the test results that the student received. The design and features of the most recent e-learning approaches show the most recent developments in this field, are based on efficient knowledge assets, and are implemented through demonstration. The fundamental component of this blend uses ontologies as a method for characterising expertise. It demonstrates how ontology can be used in research environments in an organised manner to give students content that will meet their needs and support them during the learning process.

Three algorithms—KNN, K-Means, and SVM—are used in this suggested machine learning strategy to improve the e-learning ontology. The training phase of a KNN is rather short. Since all training data are needed for the testing step, it keeps them all. K-Means is comparatively easy to use. Furthermore, SVM performs better in large dimensional domains. The clustering problem uses the unsupervised learning algorithm K-means to calculate the K-means value. KNN is a supervised learning technique that assigns each unique data location to a group at random for classification purposes. A supervised machine learning framework called Support Vector Machines (SVM) uses a fast and dependable grouping technique for classification that performs well with a limited number of features.

This system includes ontologies for the e-learning process, including lesson plans, instructional techniques, learning exercises, and learning styles. It facilitates the organisation and maintenance of course materials and the navigation of the learning content for educators, students, and staff. This system design will be suited for obtaining client variety, execution adaptability and idea reusability. K-means, KNN, and SVM are three machine learning algorithms that have been combined to improve the e-learning ontology. K-means and KNN are used for classification, while SVM is used for prediction. Using two machine learning algorithms for classification results in higher accuracy, with K-means and KNN achieving 96.37% and SVM achieving 94.67%.

Data gathering and pre processing

Various types of content, including course, score, points, duration, and recommendation, are selected as the experimental data sets. Based on statistics, determine whether or not the student study presentation is different. Here, data of various sizes (11372) and distinct groupings (course, score, points, etc.) have been gathered. The outcome is estimated using both nominal and numerical data. The datasets are all taken from kaggle and github (https://www.kaggle.com/marlonferrari/elearning-studentreactions). There are ten attributes about a student in the dataset. Name, email, degree, right response, marks received, test taken, time spent taking it, course, kind of material, and experience are among them. The student performance score, which is likewise derived in numerical form through the application of a machine learning algorithm, is compared using the numerical data.

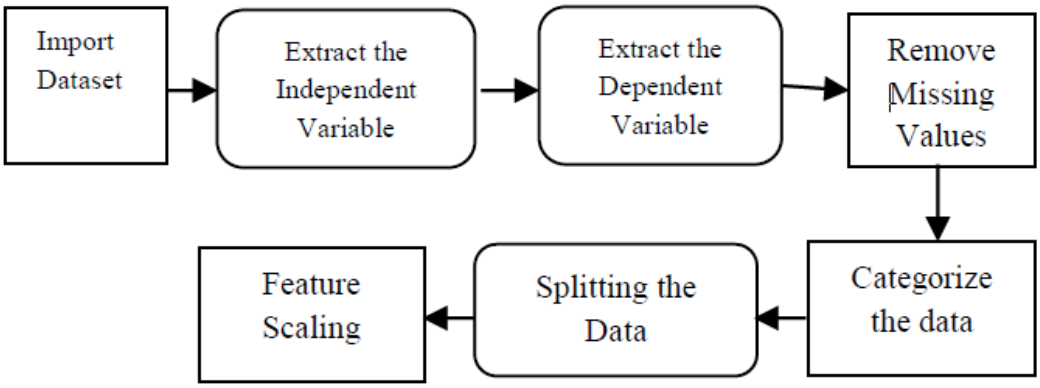

Fig.1. Block Diagram

11372 samples were taken into account throughout the training phase. The dataset is first imported, and then the independent and dependent variables are separately extracted. Next, the absent rows or values are eliminated. Subsequently, the data will be categorised and divided into several formats. In this training process, feature scaling is completed in the end.

TABLE I. Parameters used in this research work

Number of Parameters	Explanation
User_id	Unique Id for Students
Name	Name of subject which they going to take a test.
Score	Scored marks of individual student in test.
Rmdtion	Recommendation of book for each student.
Sduration	Overall average taken by student in minutes.
Eduration	Exam duration taken by student in minutes
Canswer	Correct Answers of the students while taking the test.
Wanswer	Wrong answers

In Table. 1, it represents the input variables of the student datasets i.e., User_id, Name, Score, Rmdtion, Sduation, Eduration, Canswer, Wanswer.

KNN in Ontology

First, we choose the neighbours test dataset's Kth number. Next, using the train ontology dataset, determine the Euclidean distance of K number of neighbours. The K closest neighbours will then be considered based on the calculated Euclidean distance. Calculate the number of information focusses in each class that yields the highest mean among these k neighbours. The new data points will then be assigned to the classification for which the cluster is complete and the neighbour quantity is largest. Our classification model is finally ready.

The k-nearest neighbour calculation is a process for sorting items based on the closest producing models in the provided dataset, which is used in pattern recognition or classification. KNN is a type of instance-based learning, or slow recognition, in which all estimation is permitted up until the arrangement and the volume is only approached narrowly. Among all AI estimations, the k-nearest neighbour estimate is one of the easiest. An article is grouped by a majority vote of its neighbours, such as in the unlikely event that a score is considered a boundary, a course, and so on. The item entity assigned to the category is typically well-organised among its k closest neighbours (k is a positive whole number, typically tiny). If k = 1, the article is firstly doled out to the group of its closest neighbor. The k-NN calculation can likewise be adjusted for utilized in assessing constant factors. One such execution utilizes an opposite distance weighted normal of the k-nearest multivariate neighbors.

Algorithm functions as follows:

a) Calculate Euclidean distance from target plot to those that were illustrated.

b) Order samples considering estimated distances.

c) Choose heuristically ideal k nearest neighbor dependent on RMSE done by cross validation procedure.

d) Calculate a reverse distance weighted normal with the k-nearest multivariable neighbour's.

SVM in Ontology

To prepare for training, we will first gather the highlights from the ontology dataset. After that, it will be ready and introduced to SVM using all of the training samples. Find the best data feature for each feature and categorise them. The generalisation based on each associated feature will then be calculated. Next, the characteristics will be arranged in order, and the most valuable component will be located at the top. Retrain the remaining samples in SVM once more. The classification of features is completed at this point.

K-Means in Ontology

A straightforward, well-organised procedure. First, since different points yield different results, k focusses that are located inside each cluster are identified and fixed. Following the centre placement, each focus that has a position in the deconstructed dataset is associated with the centre that is closest to it. Once all the points are connected, new k centroids are computed again, and these will be different cluster focusses from the ones that have already been characterised. A second limitation is completed, forming a circle, between the first informative index focusses and the nearest new focus. Given this circle, the k location will gradually alter its area until the focusses stop moving, completing the clustering in the process.

K-Mean’s calculation targets parting a given dataset into k discrete gatherings. The calculation will at that point discover any similitudes that exist inside the dataset and from there on execute a likeness capacity to gather the gatherings together. A proximity network is utilized in addressing the relationship that exist inside the articles in a set. In the event that the articles in the set contains recognizing object focuses or extraordinary examples in a d-dimensional space, at that point the vicinities make the distance between the focuses like the Euclidean distance.

In KNN classification, the number of neighbours, for example K should be pre-defined. A reasonable and useful methodology is utilized experimentation to identify K so that it gives the least misclassification rate. It performed such an examination with various K values going from 1 to 9 (K is picked to be odd to avoid from tie votes), and discovered K = 3 as the ideal K incentive for the application at hand.

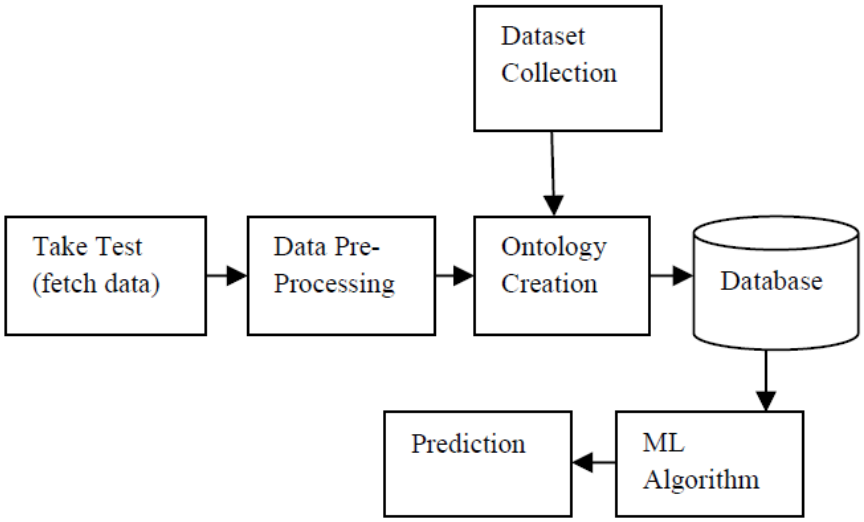

Fig.2. Architecture Diagram

Data is fetched from the tests that are taken by the candidates at first place. Data that is fetched is preprocessing before creating a ontology as shown in the above Fig 1. The ontology is created with the dataset after collecting the dataset the student can take a test, that data is pre-processed. After creating the ontology a database is created. The datasets are processed using machine learning algorithms like KNN, K-Means and SVM. Here K-Means and KNN is mainly used for classification and SVM is used for prediction of data. Finally, the prediction will be obtained.

Parameters considered in the work for performance evaluation are Score, Quadrant, Points, correct answers, wrong answers, Exam duration, Student Duration, Rating, and Feedback. The obtained score is then fitted out to which quadrant it belong to i.e. quadrant 1 ,2,3 or 4,.Each score is determined by the correct answer and wrong ones the student given while taking an exam. points are scored by considering the factors like time duration taken by each student to complete the exam/test taken and his experience shared in feedback form and rating of the test/exam which he had taken.

E-learning or electronic learning is a way of delivering the knowledge to the learners through mobile, tabs and computer. Ontology is the behavioural analysis. In ontology SVM works on the prediction of data. As well as K-Means and KNN works on the classification of the data using training samples to give the prediction.

EXPERIMENTAL RESULTS AND ANALYSIS

For each trial week, online learning behaviour factors can contain a base estimation of 0, while the greatest referent qualities will rely upon the complete number of ideas and the all-out score of each map. The base qualities for all generalization factors (generalization after the underlying test on AC-ware Tutor, the last generalization, and mean inconstancy of generalizations in a learning way) are equivalent to 0.

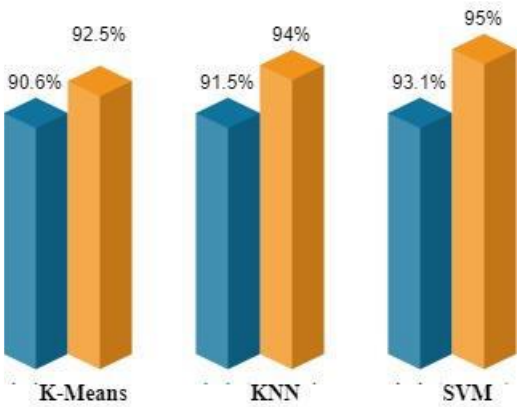

Fig.3. Graph plotted between 3 algorithms

In Fig.3. represents the accuracy percentage of each algorithm of enhancement of e-learning ontology using machine learning approach and existing system. Here, blue colour indicates the accuracy of existing system and yellow

indicates the proposed system. In this paper where each algorithm works on its functionalities. Here K-means and KNN are used for the classification of dataset and SVM for the prediction of the study material to the student according to the result he scored in the test.

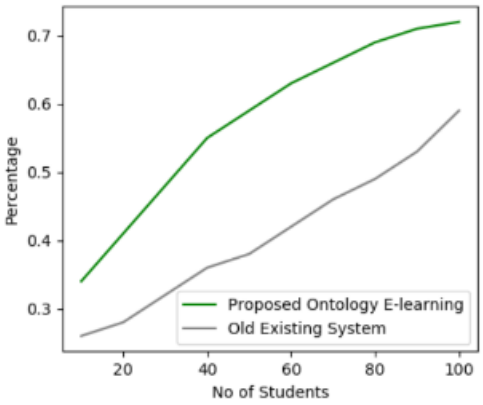

Fig.4. Comparison graph based on proposed and existing system

In this Fig.4. graph represents the enhancement of e-learning ontology using machine learning approach and existing system. In this graph proposed enhancement of e-learning ontology using machine learning approach has more accuracy compared to existing system.

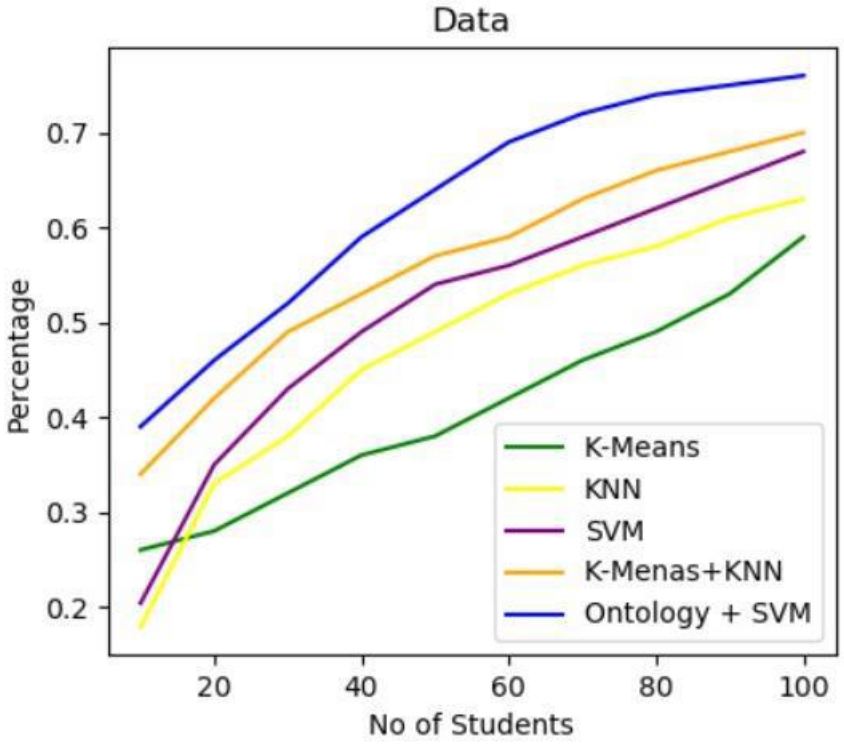

Fig.5. Comparison Graph based on techniques

In this Fig.5. represents the comparison graph based on techniques. This graph gives us the information about the different techniques like K-Means, KNN, SVM, K-means and KNN, Ontology and SVM.

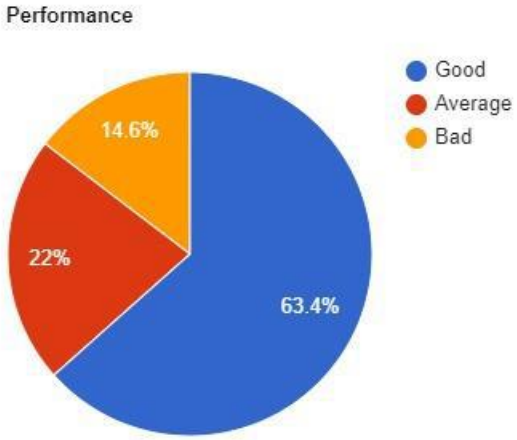

Fig.6. Pie chart of Performance

The Fig.6. represents the overall performance of the students after taking the test which is represented in the pie chart format. Each performance is classified upon the bad, good and average.

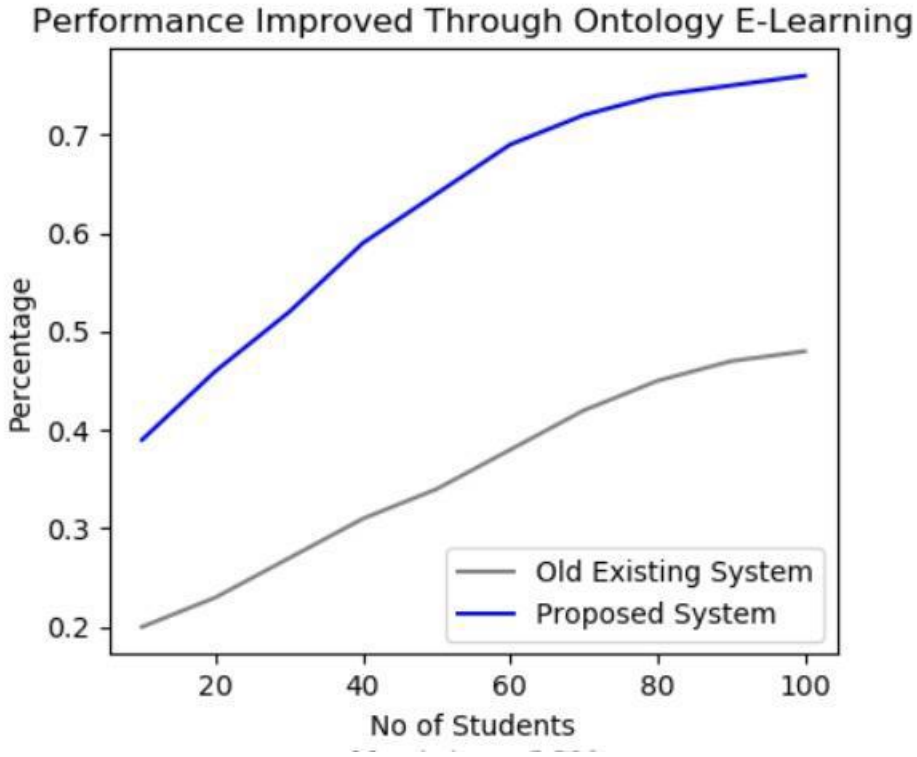

Fig.7. Graph of performance improved through ontology E-learning

The Fig. 7 represents the graph of performance improved through ontology E-learning. This graph compares between the enhancement of e-learning ontology using machine learning approach and existing system of student's performance enhancement who are all used ontology system verses who are all used other system. All Plotted values are dissimilar graphs as individual attributes and all plotted graphs are based on the comparison of enhancement of e-learning ontology using machine learning approach system and existing system. And pie chart represents the performance of the students and it is classified based on good, bad and average.

TABLE II. Datasets

Name	User_id	Score	Gender	Time Duration
Ram	U5639	5	M	122
Navya	U5639	20	F	69
Raju	U5580	64	M	40
Akash	U5659	74	M	77
Sitha	U5600	19	F	113

CONCLUSION

This study aims to provide continually dynamic, personalised e-learning content that supports the progress of data groups. An important feature for the integration of data coming from multiple sources, for supporting collaboration inside an efficient association, for clarifying data retrieval, and more generally, for thinking on available information, is the use of ontology to display the information on specific fields. The goal of this study is to use ontology in education, or e-learning. It also illustrated through facts how to create and apply them to define and carry out personalised e-learning environments. Customisation enables the implementation of an e-learning process that is more successful and productive. Enhancing ontologies is often a cooperative endeavour. This work enhances the quality of learning.

It gives teachers and students instructions on where to get more pertinent information. This study produces agents that manage an ontology-based knowledge library, hence providing an effective degree of information retrieval. Additionally, it makes it simple to obtain the appropriate information and maximises user learning and/or teaching. In terms of content utilisation, this research's ontology design can create a more structured e-learning environment. To strengthen the integrity of the e-learning system and its relationships with other e-learning systems, more ontology domains should be developed and expanded in the future.

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