

Applying Classification Techniques in E-Learning System: An Overview

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Abstract--The aim of this paper is to provide an overview of application of data mining methods in e-learning process. E-learning is concerned with web-based learning which is totally depending upon internet. Use of data mining algorithms can help to discover the relevant information from database obtained from web based education system. This paper focused on e-learning problems to which data mining techniques have been applied, including: student's classification based on their learning performance, detection of irregular learning behavior of students. This paper shows types of various modeling techniques used which includes: neural network, fuzzy logic, graph and trees, association rules and multi agent systems.

Keywords: *Data mining techniques, e-learning, fuzzy logic, association rule, multi-agent system, graph and trees.*

I. INTRODUCTION

Indeed the internet has become most popular medium for gathering and sharing the information. This is really become easy to transmit and shared the information and knowledge throughout the world. The education community has not limited or bounded itself in old education techniques, rather than it has been at the forefront of most of the changes. The best example of this is e-learning which is growing fast and spread out through the world. E-learning also referred as web-based education where large amounts of information describing the continuum of the teaching-learning interaction are endlessly generated and easily available. This could be blessing as well as curse, blessing for what on just one click plenty of information easily available on the other hand it could be seen that the unstructured information choked the educational system without providing any knowledge to its user.

Data mining was born to handle the problems like this. As a field of research, it is almost contemporary to e-learning. Data mining methods are not just as a collection of data analysis methods, but as a data analysis process that encompasses anything from data understanding pre-processing and modeling to process evaluation and implementation [1]. Data mining is the unique that the attention to the compatibility of modeling techniques with new Information Technologies(IT) and database technologies, commonly focusing on large, heterogeneous and complex database. E-learning often fit this description [2].

II. LITERATURE REVIEW

This paper present the surveyed research on data mining problems like classification technique and methods like neural network, graph and tree, fuzzy logic and multi agent system. For this many research paper have been studied and observed that some researcher have pointed to close relation between the field of Artificial Intelligence (AI) and Machine Learning (ML).

In [2][3] the authors have focused on how data mining techniques could successfully be incorporate to e-learning environment and how they improve the learning task. They have explained the classification problem in e-learning with fuzzy method, artificial neural network and evolutionary computation, graph and tree, multi-agent system and association rules. In this paper authors have presented a general and up to date survey on data mining application in e-learning. In [4] J. Upadhyay and P. Gautam have been given e-learning aspect as well as focused on different data mining methodology used in e-learning such as classification and prediction, clustering, association rule mining. They have shown how the data mining techniques can be useful in e-learning educational system to forecast course management system, student behavior, learners performance etc. In [5] the author gave details description about how data mining can be applicable in e-learning domain as well as education systems and also focused on steps of e-learning data mining process and influence of data mining in e-learning system.

III. DATA MINING AND E-LEARNING PROCESS

The main aim of education system has given the quality and better education to the students and also provides advanced learning and teaching technology. Many data mining techniques are used to improve the e-learning process. Data mining can be used to discover knowledge from e-learning system by analyzing the information which is available in the form of data generated by the users. Here the main objective is to find patterns of system usages by teachers and students. The aim of data mining is also discovering the student's learning behavior patterns. The application of data mining in e-learning system can be describe as iterative cycle where data mining applications contribute in enhancing learning and also using mined knowledge for decision [5]. Applying data mining techniques with e-learning such as classification of students based on their learning performance, clustering or grouping the similar e-learning system usages. In data mining and e-learning system predictive, association, classification modelings are interesting application on predicting student performance, designing curriculum and teacher's performance also. Predict or classify a student's performance is a very important in e-learning environment. Data mining can be useful in e-learning for many different purposes such as grouping student with similar characteristics, to grope students who are failure-driven and find common misconceptions those students process and to find dropout rates [4].

IV. CLASSIFICATION PROBLEM IN E-LEARNING

The classification is a grouping of data into classes or group. The classification problem aim is to model the existing relationship between a set of multivariate data items and certain set of outcomes for each of them in the form of class membership label [3].

A. Fuzzy logic methods

Fuzzy logic is a form of many-valued logic in which the truth values of variables may be any real number between 0 and 1. It is an approach to computing based on "degree of truth" rather than the usual "true or false" (1 or 0) Boolean logic on which the modern computer is based. Fuzzy theory was used to measure and transform the interaction between the student and the ITS into linguistic terms. Then, Artificial Neural Networks were trained to realize fuzzy relations operated with the max-min composition. These fuzzy relations represent the estimation made by human tutors of the degree of association between an observed response and a student characteristic [2][3]. A fuzzy rules-based

method for eliciting and integrating system management knowledge was proposed and served as the basis for the design of an intelligent management system for monitoring educational Web servers. This system is capable of predicting and handling possible failures of educational Web servers, improving their stability and reliability. It assists students' self-assessment and provides them with suggestions based on fuzzy reasoning techniques [6][7].

B. Artificial Neural Networks and Evolutionary Computation

Neural Network is used for classification and pattern recognition. A neural network changes its structure and adjusts its weight in order to minimize the error. Adjustment of weight is based on the information that flows internally and externally through network during learning phase. In neural network multiclass problem may be addressed by using multilayer feed technique, in which neurons have been employed in the output layer rather using one neuron [8]. Two Multi Layer Perceptrons (MLP) with one hidden layer are constructed to process the selection task and to make the decision upon learner's understating. Artificial neuron network (ANN) was used in multiple fields related to the classification tasks such as patterns and speech recognition, non-linear system identification and control. ANN discovers the hidden relations between data [9].

Evolutionary algorithms were used to evaluate the student's learning behaviors. A combination of multiple classifiers (CMC), for the classification of students and the prediction of their final grades, based on features extracted from logged data in an education web-based system, was described [10]. The classification and prediction accuracies are improved through the weighting of the data feature vectors using a Genetic Algorithm. In [11] we find a random code generation and mutation process suggested as a method to examine the comprehension ability of students.

C. Graph and Trees

The aim of graph theory is to study mathematical structures composed of elements having relationship or connection between them. The directed graph is used in e-learning system. A directed graph or digraph $G=(V,E)$,

Where V is non-empty set of elements called vertices or nodes.

And E is finite set of distinct ordered pair of vertices called edges or arcs.

Let $G = (V, E)$ be a directed graph for a personalized learning path. In G each vertex or node corresponds to a learning object. Two vertices are connected if there exists a dependency relation, such that one vertex satisfies the prerequisites of the other. So, each edge between two vertices $ARC \{u, v\}$ means that the learning object v is accessible from u . The accessibility property required to define edges between vertices relies on post and prerequisite competencies associated to each learning object [12]. For the personalization of courses e-learning model based on both the student's need and capabilities and on the teacher's profile [13]. Personalized learning paths in the courses were modeled using graph theory. A Decision Trees (DT) was used to adequate the original algorithm to distance learning issues. On the basis of the obtained results, the instructor might consider the reorganization of the course materials [3].

D. Association Rules

Association Rules refers to the data mining task of uncovering relationship among data. An Association Rules is a model that identifies specific types of data associations. AR for classification applied to e-learning process. An association rules have been investigated in the areas of learning recommendation systems learning material organization, student learning assessments course adaptation to the students' behavior and evaluation of educational web sites. Data Mining techniques such as Association Rule mining, and inter-session and intra-session frequent pattern mining, were applied to extract useful patterns that might help educators, educational managers, and Web masters to evaluate and interpret on-line course activities. A widely used algorithm for the association rules mining is Apriori algorithm. The Apriori algorithm was applied to capture relationship among URL references based on navigational patterns of students. A test result feedback (TRF) model used to analyze the relationships between student learning time and the corresponding test results. The objective was twofold: on the one hand, developing a tool for supporting the tutor in reorganizing the course material; on the other, a personalization of the course tailored to the individual student needs. The approach was based in Association Rules mining [2].

E. Multi-Agent Systems

The Multi-Agent system (MAS) monitor the interaction between the user and user interface. The MAS are a society organized, constituted by semi

autonomous agents, which interact with others. The aim of this to resolve collaboratively some problem, or to achieve some individual or collective goals. The agent may be homogeneous or heterogeneous and have common goals or not but still maintain a degree of communication between them [14].

Multi Agents Systems (MAS) for classification in e-learning have been proposed. An adaptive interaction system based on three MAS:

- The Interaction MAS captures the user preferences applying some defined usability metrics (affect, efficiency, helpfulness, control and learnability).
- The Learning MAS shows the contents to the user according to the information collected by the Interaction MAS in the previous step; and
- The Teaching MAS offers recommendations to improve the virtual course.

A multi-agent recommendation system, called InLix, was described [15]; it suggests educational resources to students in a mobile learning platform. InLix combines content analysis and the development of students' virtual clusters. The model includes a process of classification and recommendation feedback in which the user agent learns from the student and adapts itself to the changes in user's interests. This provides the agent with the opportunity to be more accurate in future classification decisions and recommendation steps. Therefore, the more students use the system, the more the agent learns and more accurate its actions become [3].

V. CONCLUSION

In this work we have presented a novel approach for use of data mining techniques for e-learning. This is a small step to give an overview of few techniques in classification method that have been applied to e-learning process. These techniques which are mentioned above fuzzy logic method, graph and trees, association rules, multi agent system played a vital role in e-learning system. Data mining techniques have an important role in e-learning system this will motivate to develop new algorithm in future scope.

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