

Mining Students' Learning Behavior in Moodle System

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ABSTRACT

In the last few years, Educational Data Mining has become an interesting area exploited to discover and extract hidden knowledge of students from educational environment data. During the establishment of this work an attempt was made to manage the extracted information using mining techniques. These methods took place in order to get groups of students with similar characteristics. The application of classification, clustering and association rules mining algorithms on the data stored on the e-learning (Moodle system) database allowed to extract knowledges that help to understand students' behaviors and patterns. Additionally, the development of a Web application for the educators is a tool to monitor their students learning behavior by monitoring the number of assignments taken, the number of quizzes taken, the number of forum post and read by students, etc. The knowledge obtained can help the instructors to make decision about their students' interacting with the courses activities in Moodle system, and to create an efficient educational environment. In this research, a Data Mining tool called RapidMiner was used for mining the data from the Moodle system database, and a web application written in PHP was established to aid teachers with statistics.

Keywords: Association Rules, Classification, Clustering, Data Mining Algorithms, Educational Data Mining (EDM), Moodle System, RapidMiner, SMoodle System, Student Behavior

1. INTRODUCTION

Concerning educational systems, the most important innovations are the introduction of new technologies as web-based education (Ha et al., 2000). It's a sort of computer-aided instruction virtually which is independent of any specific location (Brusilovsky et al., 2003). The use of these systems has grown exponentially in the last few years. Specifically, collaborative and communication tools are also becoming commonly

exploited and used in educational statements so, as a result, Virtual Learning Environments are installed in order to supplement traditional educational system which is considered as face to face courses on the one hand and to add web technologies to their courses on the other hand (Cole, 2005).

These systems seem to be a way of offering a great variety of channels and workspaces to facilitate information sharing and communication between participants in a course.

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Nowadays, one of the most widely used systems is Modular Object Oriented Developmental Learning Environment. Named also Moodle, it is a free e-learning system which enables the creation of powerful, flexible and engaging online courses and experiences (Rice, 2006). This e-learning system accumulates a vast amount of information which is very useful for analyzing student's behavior and creating a gold mine of educational data. In fact, learning management systems accumulate a great deal of log data about students' activities; reading, writing, taking tests, and even communicating with peers (Mostow et al., 2005). They provide a database that stores all the system's information: users' personal information, academic results and users' interaction data. However, due to the large quantities of data these systems can generate every day, it becomes so difficult to manage them manually, and educators are in need of tools which help and assist them in this task (Zorrilla et al., 2005). That's why researchers have begun to investigate an area containing various mining methods (Romero & Ventura, 2006). These techniques can discover useful information that can be used in formative evaluation to assist teachers establishing a pedagogical basis for decisions when designing or modifying an environment or a teaching approach. This multidisciplinary area contains several computing paradigms and some of the most useful Data Mining tasks and methods are: statistics, visualization, clustering, classification, association rule mining, sequential pattern mining and text mining.

This project named "Mining students' learning behavior in Moodle system using data mining techniques" is oriented to the specific application of data mining in computer-based and web-based educational systems. It is arranged in the following way: Section 2 named "Educational Data Mining" describes the general process of applying data mining to e-learning data, especially to Moodle usage information. Section 3 as its name indicates "Preprocessing Moodle data" details the preprocessing step necessary for adapting the data to the appropriate format. Section 4 called "Data Mining

algorithms" describes the application of the main data mining techniques on preprocessed Moodle data. Section 5 is made to present the results obtained using the RapidMiner tools and a web application, namely, SMoodle which has the goal of helping teachers to understand their students' behavior by producing statistics. Finally, the conclusions and interpretations are outlined.

2. EDUCATIONAL DATA MINING

2.1. Architecture of a Data Mining System and Its Tasks

Based on the amount of data collected in various application areas of computer science, which are becoming increasingly important and causing the need for analysis and interpretation in order to extract useful knowledge, we adopted several approaches of different nature or the purpose of:

- Sort and group the data into homogeneous classes with constraints and common characteristics between them.
- Involve items creating associations based on the research of relationships, dependencies between itemsets and subsequently extracting association rules in order to build families called frequent patterns.

Founded on the view that Data mining is the method of discovering interesting knowledge from large amount of data, the architecture of a typical system has the following major components (Han & Kamber, 2006) as shown in Figure 1.

According to the Figure 1 (Mustapasa et al., 2011), the architecture of a typical Data Mining System contains many stages as following:

- Database, data warehouse, World Wide Web, or other information repository constitutes the set of information repositories. Data cleaning, data integration and data selection techniques will be performed on the data.

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