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MINING DATA IN SYNCHRONOUS AND ASYNCHRONOUS QUERIES DURING BLENDED DELIVERY COURSES

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Abstract. The blended learning method unites the traditional and distance learning models. In Vilnius Gediminas Technical University (VGTU) this model is used for part-time, extramural and distance studies. Thus, a need to develop and implement distance learning system has occurred, in order to satisfy all students', teachers' and administration needs. Using IBM technologies there is developed an environment for student centered learning at Information Technologies Department.

Data mining technology can help to find interesting and useful patterns in huge volume of data. However, identify the best prospects is not enough to improve customer value. Data mining is not yet engaged into e-learning systems. This paper introduce how is possible to profit from integration of data mining and the e-learning technology.

Key-words: distance learning, blended learning, information system, data mining, web usage mining

1 Intoduction

Today's universities and education institutions temporizing with the modern day circumstances should at most approach to students and assure the potential for them to study, contribute up-to-date knowledge for everyone by all available ways. Thus, part-time and extramural studies are coming apace back to study programs at VGTU, and distant learning is plugging its way.

Such a system is implemented and continually improved, taking into account the changing situation and emerging user needs, and new technologies. The system substantially changes the approach towards teaching and learning, new methodologies and technologies.

This system should unite various e-learning methods, control teaching and learning processes effectively, ensure the highest possible of studies quality and service. It is the main task of our scientific research.

In distance learning, much emphasis has been given to the pedagogical concepts of student centered learning and student motivation, resulting in the design and delivery of high quality courses in higher education as well as more generally in resource based education. We want to use blended learning method. The term *blended learning* is used to describe a solution that combines several different delivery methods, such as collaboration software, Web-based courses, and knowledge management practices. Blended learning also is used to describe learning that mixes various event-based activities, including face-to-face classrooms, live e-learning, and self-paced learning.

Technology is changing rapidly. Everything is moving to the web, like data and information; people and communication; the applications people need and use.

2 Blended Learning

E-learning is technology-enabled learning. There are many types of e-Learning technology, including the live virtual classroom. Once we have seen the different approaches to e-Learning and the various underlying technologies required to deliver it, let us see what *blended learning* is about. Blended learning means different things to different people [1]:

- To combine different modes of Web-based technology in a single learning program (live virtual classroom, and asynchronous collaborative work).
- To combine various pedagogical approaches (for example constructivism, behaviorism, and cognitivism) to produce an optimal learning outcome with or without instructional technology.
- To combine any form of instructional technology (combine videotape, CD-ROM, Web-based training, film) with face-to-face instructor-led training.
- To mix or combine instructional technology with actual job tasks.

The blended e-learning method could be founded and realized using Learning Space Virtual Classroom technology.

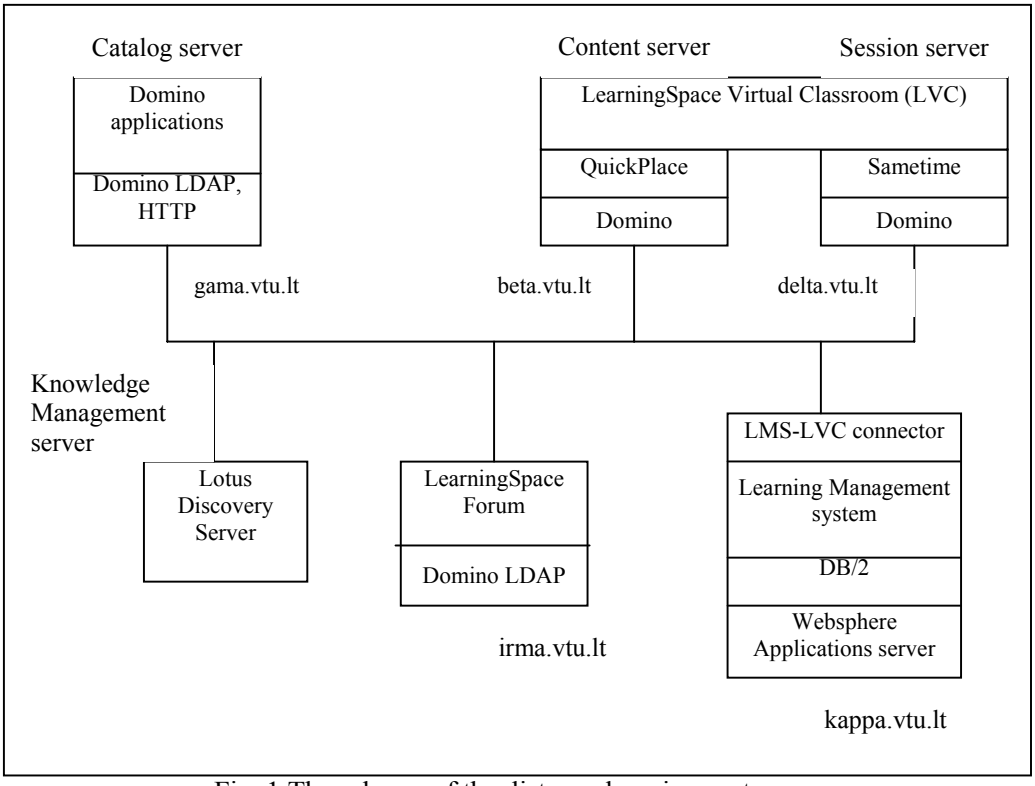

Fig. 1 The scheme of the distance learning system

3 IBM Learning framework at VGTU IT department

Since 1994 VGTU Information Technologies department participates in IBM Scholarship program [2] and has an opportunity to use IBM providing software for creating an interactive learning environment.

We have analysed the literature about e-learning methods and about the using technologies as well. This analyse let us project the scheme of the distance learning system (Fig. 1). This scheme should help to establish courses putting into practice the blended e-learning method. The scheme is being used and tested.

Lotus Domino is a server that provides an ideal communications infrastructure by tightly integrating

the robust functionality of enterprise-ready, client/server messaging and groupware with the open standards and global reach of the World Wide Web. Domino enables individuals and organizations to communicate with colleagues, collaborate in teams, and coordinate business processes within and beyond their organizational boundaries to achieve a competitive edge. Domino supports a variety of clients and devices, including Web browsers, Lotus Notes clients, and various mail and mobile clients.

Lotus Notes is an enterprise or workgroup-computing environment that helps people work together effectively, regardless of platform or technical, organizational, geographical, or time-based boundaries. Lotus Notes based information can be shared across any distance, at any time.

LearningSpace is the product family and platform that integrates the Lotus vision for solutions for anytime learning. LearningSpace, built on Lotus Domino, provides the market's best framework for asynchronous collaborative learning.

IBM *Web Sphere Application Server* lets you achieve your "write once, use anywhere" goal for servlet development. The product consists of a Java-based servlet engine that is independent of both your Web server and its underlying operating system. Application Server offers a choice of server plug-ins that are compatibles with the most popular server application programming interfaces.

LearningSpace - Virtual Classroom provides a framework for designing, scheduling, managing, and delivering virtual classroom courses, as well as managing participants.

IBM Lotus LearningSpace - Virtual Classroom offers the following functions [1]:

- Course builder – provides the framework for building outlines, selecting virtual classroom tools, authoring assessments.
- Course scheduling – allows you to schedule courses.
- Notifications – handles course invitations and reminders.
- Course catalog – lists all available courses, or the courses in which a learner has enrolled.
- Enrollment manager – administers the enrollment and admission of learners in courses.
- Administrative tools – includes user management, enrollment reports, security settings, and the like.

Not all the functionality of LearningSpace - Virtual Classroom is based on synchronous technology. The synchronous functionality is delivered by Lotus Sametime technology while the asynchronous functionality is based upon Lotus QuickPlace technology.

LearningSpace - Virtual Classroom can be used either as a standalone product or in combination with a Learning Management System [3].

A *Learning management system* (LMS) plays a key role in the e-Learning environment. Its primary function is to manage learner information, administration, and access to courses. It is most often referred to as the "learning portal" that links users with the various learning activities. In some cases, it is used to manage the course catalog and to link different types of e-Learning activities together in order to deliver a blended solution.

A Learning Management System often delivers the following functionality [4]:

- Learner enrollment
- Learner administration
- Tracking management and information scoring
- Reporting
- Curriculum management
- Competency management
- Skill gap analysis
- Classroom-based training management
- Live virtual classroom management
- Sessions and learning activities scheduler
- Learning resource management
- Course catalog, including advanced search capabilities
- Common course authoring management

An LMS usually relies upon a standard HTTP server for delivery and uses a relational database system for its data storage. Examples of LMS systems are Saba, Docent LMS, Blackboard, IBM LMS1 and TopClass. We use IBM LMS1.

Knowledge management (KM) systems can be a part of a learning solution. In our scheme it is presented as *Lotus Knowledge Discovery Server*. KM and e-Learning used to be two separate worlds, but they are now starting to converge [5]. A KM system can, for instance, allow curriculum planners, instructors, or learners to search for subject matter experts in the corporation, or find existing relevant materials within a company's intranet.

In Information Technologies Department there is an implemented information system. It contains various libraries of data, such as various documents of the department; library of Bachelors' final works, Master theses, and administration documents; library of e-books; news page, user's catalogue, schedules, virtual jobcentre and etc

4 Data Mining and E-learning

Data mining is an interdisciplinary field that brings together techniques from machine learning, pattern recognition, statistics, databases and visualization to address the issue of information extraction from large databases [6, 7].

A combination of data and, maybe, text mining techniques can help determine user interests – early in the process of the visitor's interaction with the website. This allows the website to act interactively and proactively and deliver the most relevant customized resources to the visitor.

Data mining applied to the Web has the potential to be quite beneficial. Web mining is mining the data related to the Web. This may be the data actually present in Web pages or data related to the Web activity. Web data can be classified into [6]:

- Content of Web pages
- Intrapage structure includes the HTML or XML code for the pages
- Interpage structure is the linkage structure between Web pages
- Usage data that describe how Web pages are accessed by visitors
- User profiles include demographic and registration information obtained about users (fig. 2)

There are many different techniques that can be used to search the Internet. Most search engines are keyword based. Data mining techniques can be used to help search engines provide the efficiency, effectiveness and scalability needed [6].

The implementation of data mining techniques to blended delivery courses can help to understand visitors needs, for instance, modification of web page to better fit for the user, Web page creation that are unique per user or using the desires of a user to determine what documents to retrieve.

There are four most common tasks of data mining [8, 9]:

distant learning courses in Learning Space system,

- *Association rules*. These are descriptive patterns of the form A implies B, where A and B are statements about the values of attributes of an instance in a database. In the e-learning database a data mining system may find associations rules such as: learners from 25 to 30 years old with an income of 200€ to 300€ registered for Distant Learning in Information Technologies course.
- *Clustering*. The clustering model also known as segmentation model. Clustering analyses data objects without consulting a known class label. In general, the class labels are not present in the training data simply because they are not known to begin with. Clustering can be used to generate such labels. The objects are clustered or grouped based on the principle of maximizing the intraclass similarity and minimizing the interclass similarity. That is, clusters of objects are formed so that objects within a cluster have high similarity in comparison with one another, but are very dissimilar to objects in other clusters. Each cluster can be viewed as a class of objects from which rules can be derived [6].
- *Classification and prediction*. This refers to discovering predictive patterns where a predicted attribute is nominal or categorical. The predicted attribute is called the class. The derived model is based on the analysis of a set of training data and can be represented in the form of classification rules, decision trees, mathematical formula, neural network and etc [10]. Universities which are providing e-education may be interested, for instance, in classifying courses to expensive, cheap or, maybe, more attractive, normal, etc.
- *Forecast*. This term refers to using the content of the database, which reflects historical data, to automatically generate a model that can predict a future learner's behaviour. Neural networks are the most common forecasting technology in data mining.

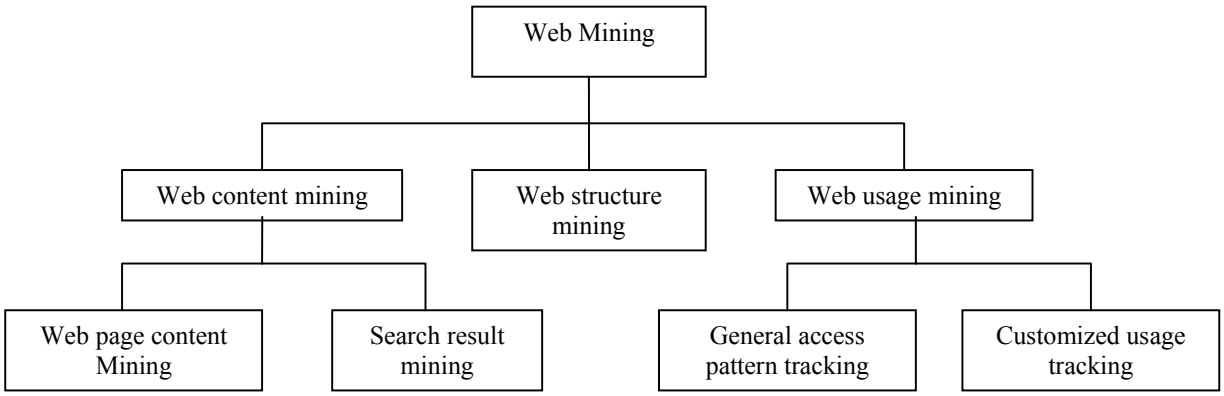

Fig. 2 The taxonomy of Web Mining

4 Conclusions

Applying data mining to e-learning would enable to help the learners who are interested in certain areas by suggesting relevant or complimentary courses of which they might not be aware in an efficient way providing them with a personalized registration web page. Learning providers will have a possibility to view data of learners and courses from different point of views in order to have the full picture, enabling to make the most profitable decision targeting the class of users of interests, investing more in courses which are required by learners.

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