An agent -based Intelligent System to enhance E-Learning through Mining Techniques

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Abstract:

The growth of Internet has created new ways for education systems. Learners and teachers realize their pedagogic activities with less effort, time and money. Agent Based Intelligent System (ABIS) have proved their worth in multiple ways and in multiple domains in Education. In this paper the application of an agent-based Intelligent System for enhancing E-learning is introduced.

An ABIS is a system that provides direct customized instruction or feedback to students without the intervention of human beings. With the explosion of content on the World Wide Web (WWW), the scope of application of Data and Web Mining to E- Learning applications has increased tremendously. In this work, we identify a set of applications which go one step ahead from ABIS and use the WWW to aid the learning process of the "learning object content". Each application has a high level of coupling with the knowledge representation model, which models the resources stored in the Digital Library.

This research presents the architecture for simplifying and automating the process of creating the domain model for an intelligent e-learning system. In this work we present an Knowledge representation of educational resources, using the World Wide Web. The effective and accurate intelligent systems based on the mining technologies have become the most important research issue. An agent-based recommendation system helps communities of learners in searching the web for information.

This paper reports on the conceptual structure that has evolved to define the development process for the pedagogical agents. It also proposes getting rich source of Information, such as the hyperlinks among pages or the Web usage information using web data mining technology Based on intelligent search systems and here we propose an architecture model of e-Learning process using the agent paradigm.

Keywords: *ABIS, Mining Techniques, Pedagogical agents, Knowledge representation, search systems-learning*

Introduction

ABIS is a software tool designed initially to manage user learning processes. ABIS go far beyond conventional training records management and reporting. The value-add for ABIS is the extensive range of complementary functionality they offer. Learner self-service (e.g. self-registration on instructor-led training), learning workflow (e.g. user notification, teacher approval, waitlist management), the provision of on-line learning, on-line assessment, management of continuous professional education, collaborative learning (e.g. application sharing, discussion threads), and training resource management (e.g. instructors, facilities, equipment), are some of the additional dimensions to leading learning management systems.

In addition to managing the administrative functions of online learning, some systems also provide tools to deliver and manage instructor-led synchronous and asynchronous online teaching based on learning object methodology. These systems are also called Learning content management systems. An ABIS provides tools for authoring and re-using or content as well as virtual spaces for learner interaction (such as discussion forums and live chat rooms).

ABIS provide instructors with the ability to perform the following tasks:

• Place course materials online.
• Track student progress - through assessment features and can post student grades.
• Discussion board- instructors and students can discuss
• Other communications tools - let instructors send announcements to classes and
communicate individually with students.
• Lock box for students - students can store class materials in a safe place
• Course statistics - provide information on the use of the course site

ABIS also have proven popular in managing asynchronous academic distance courses, too, because of their ability to manage discussions. When using a ABIS to manage a distance course, instructors post a core lessons master script, of sorts, that guides students through readings, discussions, and learning activities instead of merely posting readings and PowerPoint slides for each lesson,. Instructors then use the discussion board to manage the course discussions, which are usually more extensive than those used in classroom courses. The One of the interesting results from Web architectures for ABIS is something called collective intelligence.

Agent Based Intelligent Systems (ABIS)

ABIS providing a personal training assistant for each learner is beyond the training budgets of most organizations. However, a *virtual* training assistant that captures the subject matter and teaching expertise of experienced trainers provides a captivating new option. The concept, known as ABIS or intelligent computer-aided instruction (ICAI), has been pursued for more than three decades by researchers in education, psychology, and artificial intelligence. Today, prototype and operational ABIS systems provide practice-based instruction to support corporate training, schools and college education, and military training.

The goal of ABIS is to provide the benefits of one-on-one instruction automatically and cost effectively. Like training simulations, ABIS enables participants to practice their skills by carrying out tasks within highly interactive learning environments. However, ABIS goes beyond training simulations by answering user questions and providing individualized guidance.

Unlike other computer-based training technologies, these systems assess each learner's actions within these interactive environments and develop a model of their knowledge, skills, and expertise. Based on the learner model, ABIS tailor instructional strategies, in terms of both the content and style, and provide explanations, hints, examples, demonstrations, and practice problems as needed.

Components of an ITS
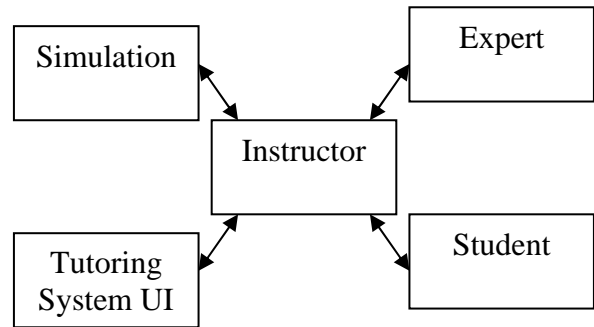
Strength of ABIS

• They provide the benefits of one-on-one instruction automatically in a cost effective manner.
• ABIS- taught students generally learn faster and translate the learning into improved performance better than classroom-trained participants.
• Provides direct feedback to the students without the intervention of human beings.

ABIS systems are intelligent and have the basic goals of making the learning process efficient for the students and reducing the work required to be done by the teacher. They model how a teacher would teach in the class and also keep a track of the student's performance. Such systems use the record of students' performance to enhance their learning process. However these systems are expensive to build and model.

ABIS require much human expertise and are domain specific. ABIS system is a one stop solution to making the learning process efficient. These systems are difficult to build but it is as easy a Content Management system for the use of the teacher (eliminating the task of annotating the sources), involves high participation from the user

and is also intelligent enough to make the user learning process easier and efficient.

The Approach

We propose the addition of intelligent applications to the ABIS. The work focuses on helping a teacher moderate a classroom of students using ediscussion (educational discussion) tools in which the students comprise multiple discussion groups. Generally a teacher can bring to bear his or her experience and moderation expertise to steer the discussions when problems occur and provide encouragement when discussions are productive. However when multiple e-discussions occur simultaneously, a single teacher may struggle to follow all of the discussions. To direct the teacher's attention to the 'hot spots,' this paper proposes software tools that pre-process, aggregate, and summarize the incoming flood of data. It Proposes Information Retrieval techniques to detect conflicts within the same exam. A Conflict exists in an exam if at least two questions within that exam are redundant in content, and/or if at least one question reveals the answer to another question within the same exam.

With the explosion of Web architectures, the content on the web has increased manifold. This has provided the user with treasures of information. However there is a catch here. Since the number of sources that present the same content to the user is large, a large portion of the user's time is spent in searching for appropriate material on the web. The same logic applies to students. Also there exist no educational search engines that focus only on educational content.

Applications that can be developed to cater to the above problems:

• **Recommendation Engine:** This engine would implicitly help the user in getting similar content. When a student is reading a lecture then similar content would be automatically recommended to him. The recommendation would be content diversified and he/she will be recommended lectures/tutorials on that particular subject from the digital library. The Recommendation will be personalized

• **Educational Search Engine:** This will provide two additional capabilities in addition to keyword based search, namely (i) Content based search for similar courses, and (ii) The mining techniques Provides the following applications:

• **Automatic Evaluator for Coding Assignments:** The answer is same for every student.

• **Automatic Question Answering:** One of the major advantages of ABIS is the discussion forums. However it may so happen that a question/query asked by a particular student may have been answered before in some other course.

• **Duplicate Detection in Assignments:** This application would detect duplication in submitted assignments by the use of text matching algorithms. While putting up new course, assignment or a lecture, similar resources would be available from the digital library either by search or by recommendations.

Applications of a Knowledge representation
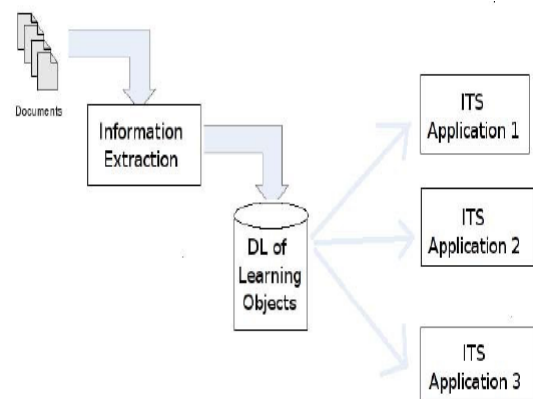
Mining the data from web

Web Mining is an important sub-branch of Data Mining. Data mining is defined as a technique of finding hidden information in a database. It may be called as data driven discovery, explorative data analysis, deductive learning. Web mining is mining of data related to the World Wide Web. This may be data actually present in Web pages or data related to the Web activity. What is being suggested here is that the e-learning software will be better able to penetrate the world of e-learning through Web mining. This paper is partly about the underlying conceptual and pedagogical issues of the e-learning environment.

Agent Technology

A key area in current software engineering activity is the utilization of what are called agents in the interactions between software, the user and communication devices.

Introduction to intelligent agents in the educational environment and the concept of the pedagogical agent is not new. The use of pedagogical agent in this paper reflects a wider perspective on the possible use of agents. This paper is primarily concerned with defining pedagogical agents as intelligent interactive software tools often including what is called an guide. Working from a different perspective, we are interested in the role of the agent in a monitoring and evaluation function that need not include any interaction with the user.

We see our form of pedagogical agent being concerned with establishing user behavior and response patterns that help evaluate:

• The functionality of the educational software

• The way the learning materials contained in the software aid learning

• The extent to which the use of the software in the learning environment has met the underlying educational objectives

An intended future development from this starting point will be the development of intelligent, interactive agents that are programmed to use the information extracted during the monitoring phase. The issues here also apply to many Web-based learning tools where the learner has a much wider scope for action that the learning task might have required. In fact, Web-based tools may have been generated with the intention of encouraging exploration beyond the basic task.

Proposed Architectural Model for ABIS based E- Learning
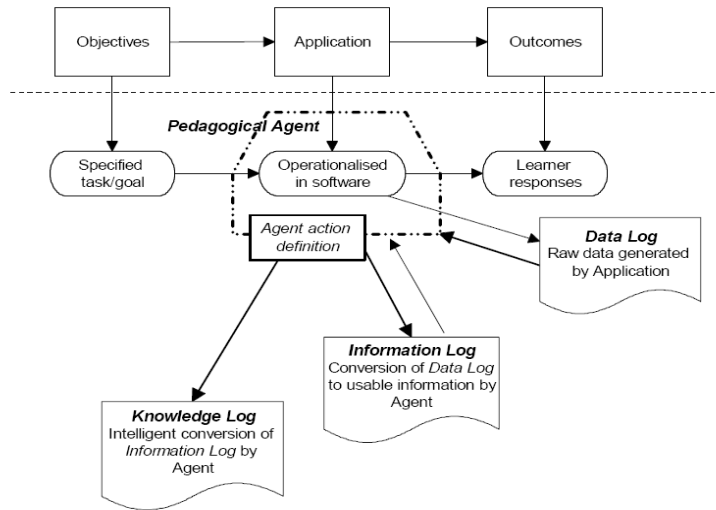
Agent technology and evaluation

Most e-learning software has not been designed to be a primary source of information on the educational performance of the users. Where the principal area of interest is Web usage then Web logs can sometimes be generated and there is a growing literature on how best to analyses the vast quantities of information that is included in a Web log file. The 'hidden' environment that is created by e-learning tools can most easily be explored through software tools that can tap into what is being output by the e-learning software. Agents may increase system robustness in environments where communication between agents and their controllers may be difficult. Agent systems are inherently modular by nature and therefore improve system maintainability and they may take advantage of distributed computing resources.

• **Intelligent search agents :** This class of agent deployed on the web automatically searches for information and it deems relevant to a particular search query using domain characteristics and user profiles to organize and interpret the discovered information.

• **Information filtering/categorisation agents :** These agents use a number of techniques and characteristics of hypertext documents to automatically retrieve, filter and categorize web

documents according to some predefined criteria or user interaction.

• **Personalized web agents:** This type of web agent learns user preferences and then automatically discovers web documents and resources based on the created user profile.

Intelligent search engine technology based on mining technique

Agents are used to perform some action or activity on behalf of a user. Each user is assisted by his/her own personal agent to search the web. The major goal of each personal agent is to propose to its user and to other agents links to web pages that are considered relevant for their search. Personal agents can use different internal and external sources of information. The personal agents are software agents running on the server.

The Intelligent search engine helps to obtain the optimized search results from the data preserved in the digital library of the web pages. Here we have a proposed architecture of an agent-based intelligent search engine system for effective web mining is shown below
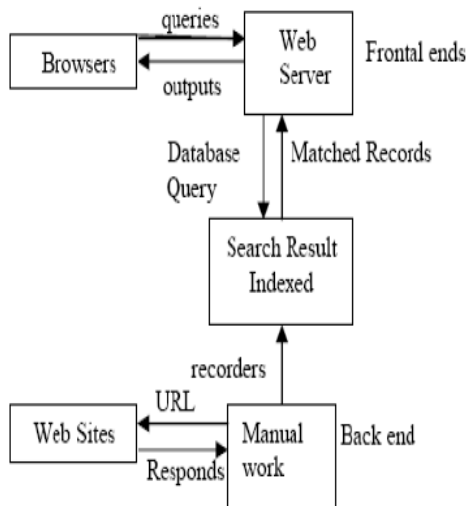
Search engine summarization

We have a need to improve the technologies of information retrieval techniques for multimedia contents. These factors give rise to the necessity of creating server-side and client-side intelligent systems that can effectively mine for knowledge both across the Internet.

Conclusion

In this work, we have presented a novel approach for use of data mining for e-learning. With the explosion of the internet particularly because of the web architectures, a content repository has accumulated over the World Wide Web. This abundance of information if tapped efficiently can act as a very good learning resource for an intelligent tutoring system. This work is a step in the direction of bridging the information gap between an e-learning and an Agent Based Intelligent System (ABIS).

The work presented in this paper is done keeping in mind a novel set of applications which will be developed for the e-learning and ABIS. We have surveyed current trends and techniques used to represent knowledge. We have then presented architecture with a set of methodologies by aggregating and customizing the state of the art research in e-learning domain.

Future Work

Although we have done a lot of research on the tools developed and used in the industry as well as academia, our survey is not complete. A more thorough survey of current trends in the applicability of Mining techniques to E-learning needs to be done. A large collection of data is to be collected to test the proposed architecture.

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