An Agent-based Intelligent Tutoring System for Enhancing E-Learning/E-Teaching

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Abstract

The main objective of this paper is to develop a methodology for automated system for intelligent tutoring that will provide direct customized instruction of feedback to students. This does not need the intervention of human being. The learning system will not perform effectively unless the domain model is complete and accurate. For simplifying and automating the process of creating the domain model for an intelligent E-learning system two parameters are required . Cognitive parameters i.e. attributes such as performance, capability, commitment and Behavioral parameters such as pleasure, fatigue, distortion are also required for development of data mining Algorithm used in Intelligent Tutoring System. The selection of such parameters is performed by data mining method using Multi-agent system.In this paper, we propose an behavior model for a student, which combines the behavioral and cognitive state of the student and the institutional situation to establish the effective and pedagogical actions.

Introduction

Learner in a classroom has a personal training assistant , who pays attention to the participant's learning needs, assesses and diagnoses problems, and provides assistance as needed. The assistant could perform many of the routine instructional interventions and alert the instructor of learning problems that are too difficult for it. By taking on basic assistance tasks, the instructor would be free to concentrate on training issues that require greater expertise. 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 intelligent tutoring systems (ITS) 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 ITS systems provide practice-based instruction to support corporate training, schools and college education, and military training.

The goal of ITS is to provide the benefits of one-on-one instruction automatically and cost effectively. Like training simulations, ITS enables participants to practice their skills by carrying out tasks within highly interactive learning environments. However, ITS goes beyond training simulations by answering user questions and providing individualized guidance. Unlike other computer-based training technologies, ITS 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, ITSs tailor instructional strategies, in terms of both the content and style, and provide explanations, hints, examples, demonstrations, and practice problems as needed.

The main goal of the virtual lab is to serve as learning tool for students. We have incorporated an *Intelligent Tutoring System* (ITS) into its

architecture. In most developments of ITS, the tutor-student interaction has been unnatural, i.e. students interact with system by means of buttons and menus. However, in the last few years, research on human-computer interaction has tried to mimic human interaction. Most recently, researchers in computer science have turned towards an aspect which was originally believed to be unrelated to computer systems performance emotions. Scientific studies have demonstrated the influence of emotions in human communication; and a hypothesis is that it can also happen in the human-machine interaction. In an ITS, this hypothesis becomes stronger, since emotions have been identified as important players in motivation, and motivation is very important for learning . When a tutor recognizes the affective state of the student and responds accordingly, it may be able to motivate students and improve the learning process. There are several authors who propose to use the affective state of the student to give him a more suitable response that fits with his affective and cognitive state. However, the affective state has not yet been used to decide the pedagogical response. This is because there are still many questions about emotions without response, such as which affective states are relevant for learning. In this work, we will propose a behavior model for a student, which combines the behavioral and cognitive state of the student and the institutional situation to establish the affective and pedagogical actions for e-learning.

Brief Review of the Previous Work (National and International)

A cooperative intelligent tutoring system which adopts a multi-agent approach, is applied to Musical Harmony domain. This system integrates an ITS with a Web hypermedia component resulting in a Web-based distance educational system. Evandro de Barros Costa et. al proposed in their work essential idea to define and develop an environment that provides effective means to involve human learners, tutoring system and human teachers, in productive cooperative interactions based on problem solving situations. The system architecture consists of eight main entities: Learner, Teacher, Human Expert System, Set of artificial tutoring agents, Hypermedia Component, as well as, three interfaces modules to assure interactions between theses entities. Here we give an overview of the system, emphasizing the multi-agent system and the main interactions between human and artificial agents. They also bring out particular aspects related to domain knowledge modeling and its consequences in the multi-agent design, learner modeling, and a mechanism from the tutoring system to supporting adaptive navigation on the teaching material.

Agathe Merceron and Kalina Yacef illustrated by the logic-ITA that how online tutoring may be used to improve both learning and teaching. Student benefit from a tutor which can give them Step by Step feedback. Tutor gets a chance to understand their mistake quickly. As they make them, not only after getting back their work from a human tutor. Querying the database are about the student with the subject and but also they get to know about the common mistake made. They may extract hidden information like a mistake often associated together and that way reflect on their way of explaining concept to student. Different data mining techniques for classifying student based on their MOODLES usage data and final marks obtained in their respective courses are compared by *Cristóbal Romero, Sebastián Ventura, Pedro G. Espejo and César Hervás*. *Andrej Kriˇstofiˇc M ´aria Bielikov ´a* present techniques for data mining, which can be used to discover knowledge about students' behavior during learning, as well as techniques, which take advantage of such knowledge to recommend students lessons they should study next. *Andrej Kriˇstofiˇc M ´aria Bielikov ´a* also describe a process of recommendation based on knowledge discovery and present an architecture of a web-based system, which uses proposed approach to improve adaptation. The adaptation in most of current educational adaptive hypermedia systems is driven

by a fixed set of rules.

Eliane Pozzebon, et. al. propose a multi-agent intelligent tutoring system building tool that integrates different formalisms in order to facilitate the teacher task of developing the contents of a tutorial system and at the same time to provide adaptiveness and flexibility in the presentation. The adopted formalisms are ground logic terms for the student model, data-bases for the domain model and object Petri nets for the pedagogical model. The interaction between the student and each agent of the system is controlled by an object Petri net, automatically translated into a rule-based expert system. The object Petri net tokens are composed by data objects that contain pointers to the student model and to the domain knowledge, stored into a data-base of texts, examples and exercises. The object Petri net transitions are controlled by logical conditions that refer to the student model and the firing of these transitions produce actions that update this student model.

S.No.	Method	Cognitive Features	Behavioral Feature	Ai-techni-ques	Data-mining techniq-ue	Data mining Software
1.	Merceron,Yacef proposed method	*Yes*	*No*	Not specify	Not specific	Logic-ITA tool
2.	Romero,Ventura, Pedro G, Hervas proposed method	*No*	*No*	probabili stic	Classificat ion, Artificial Neuralnet	Moodle tools
3.	MERCERON and YACEF proposed method	*No*	*Yes*	Not specify	Not specify	Clementine 11
4.	C. Pahl proposed method	*No*	*Yes*	NO	Classificat ion	Not specified
5.	Andrej , Bielikov proposed method	*No*	*Yes*	Probabili stic	Not specific	AHA! and ALEA tools
6.	Elena , Luis proposed method	*No*	*Yes*	Probabili stic	Not specific	OLAP tools
7	Cecilia E. P. Giuffra, Ricardo Azambuja Silveira	*Yes*	*No*	Multi-Agent	No	No
8	Kanmani, S. ; Induja, R. ; Hemalatha, H.	*No*	*No*	Multi-Agent	No	No
9	Evandro de Barros Costa	*Yes*	*No*	Multi-Agent	No	No
10	Eliane Pozzebon	*Yes*	*Yes*	Multi-Agent	No	No

According to Simone Riccucci et.al. in the last years Intelligent Tutoring Systems have been a very successful way for improving learning experience. Many issues must be addressed until this technology can be defined mature. One of the main problems within the Intelligent Tutoring Systems is the process of contents authoring: knowledge acquisition and manipulation process is a difficult task because it requires specialized skills on computer programming and knowledge engineering. In this paper we propose a mechanism based on first order data mining to partially automate the process of knowledge acquisition. The knowledge has to be used in the ITS during the tutoring process for personalized instruction. Such a mechanism can be applied in Constraint Based Tutor and in the Pseudo-Cognitive Tutor.

Very limited number of works are available which try to implement cognitive as well as behavioral parameter for selection of student in negotiation. These work also provide the implementation of cognitive and behavioral parameter for agent based coordination and cooperation approach. There is no complete deterministic computational model for cognitive and behavioral parameter. Further due to availability of many type of cognitive and behavioral model using different domain, it may also always confuse the developer of a multi agent based system to select a particular approach to meet his requirement for negotiation. It is also observed that the use of software agent in e-learning system is considered to be very important as is also discussed in the agent mediated agent e-learning. The software agent can be highly beneficial to achieve the degree automation. It is also found that the reported literature on agent based negotiation in e-learning provides a limited modeling for the selection of potential (best) student and institutional agent. So cognitive, behavioral and trainee orientation based on potential student and institutional agent will be a valuable advancement in the related field.Data mining is one of the important techniques of agent based system for categorization of agent according to their characteristics. Very few work are reported which discuss about the DM in multi agent based negotiation process. It can be observed that DM can play an important role in ordering importance of various cognitive and behavioral parameters.

Problem Statements

New concepts and methods are needed to extract more complete and detailed information of the behavior model for a student. In response to such a demand, this research plans on how to develop *an efficient strategy integrated with deterministic and probabilistic agent based model algorithm for finding behavior of student with coordination and cooperation functionality for selection of best tutor agent in e-learning environment.* Various cognitive factors, by which trust is chosen to determine the behavior of software tutor agent for ITS. Pattern of knowledge that was extracted from trust should have capabilities with the options of ITS parameters especially the features of behavioral features of student. The Pattern of knowledge also applied with the features of behavioral features of student.

Problem Description

Using interview and conducting the test find out the Cognitive Index Factor with the help of performance, desire, intention, capability, commitment, preferences parameter of a student. Understanding face and Behavioral analysis calculate Behavioral Expression Index Factor. Finally using Cognitive Index Factor and Behavioral Index Factor we are calculating Student Index Factor. The problem is also described by collecting information on Cognitive Factor and Behavioral Factor parameter focusing on the category of agent. Data Mining (DM) helps to extract and analyze the meaningful relationship between various Cognitive and Behavioral parameter and it also provides relative importance of various parameters based on records. The following term are defined and illustrated in this context. The above definition is related to the cognitive feature of student and institutional.

The objective is to provide more efficient approach for multi agent model with data mining method for classify student providing proper deterministic and probabilistic formalization of cognitive, behavioral and institutional orientation parameters. Parameter for selection of student and institution (tutor) agent and use of institutional orientation and logical method determine pair of potential student and institution (tutor) for competitive and cooperative domain in e-learning environment.

Requirement of Design and development:

As the figure at stage 1 following process is performed:

- Database provided by an agent mediated e-organization
- Confirm cognitive factors & behavioral factors for categorization of agent
- Data Processing & cleaning
- Produce training data sets

At stage 2 developed data mining based predicative

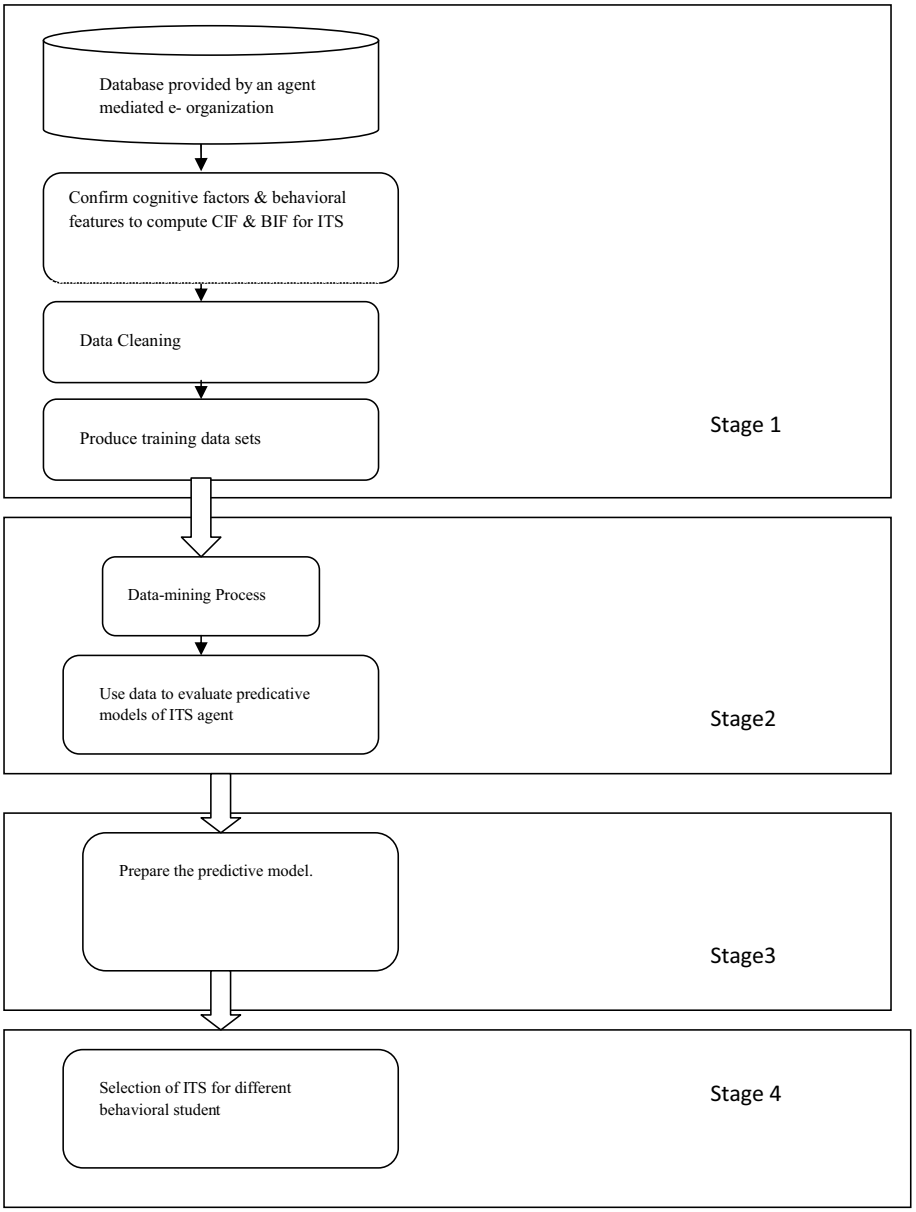

Figure: Flow diagram

models for pattern of knowledge.

At stage 3 prepare the same category of agent pair through output of predictive model. At stage 4 Coordination and cooperation for agent process between most reputed ITS agent.

Hence from the above table it is clear that our approach can fulfill all the necessary features for ITS process.

Performance evaluation

Comparative view our proposed method with other proposed method

S.No.	Method	Cognitive Features	Behavioral Feature	AI Techinique	Data mining Software
1	Proposed own method	***Yes***	***Yes***	Probabilistic and Deterministic	WEKA,IBM Modular, R
2	**Mercero n,Yacef proposed method**	***Yes***	***No***	Probabilistic	Logic-ITA tool
3	**Romero,Ventura, Pedro G, Hervas proposed method**	***Yes***	***No***	Probabilistic	Moodle tools
4	**MERCERON and YACEF proposed method**	***No***	***Yes***	Not Specify	Clementine 11
5	**C. Pahl proposed method**	***No***	***Yes***	Deterministic	Not specified
6	**Andrej , Bielikov proposed method**	***No***	***Yes***	Not Specify	AHA! and ALEA tools
7	**Elena , Luis proposed method**	***No***	***Yes***		OLAP tools

Conclusion

Based on the scope and limitation of research, we assume the research will produce few cognitive features as their output. Defining efficient model is the last output in this research and the output would be analyzed only for the buyer and seller behavior. We will propose the model integrated with mining process and cognitive agent technology. It would be useful for academic organization for implementation task allocation in ITS based system. It would automate tutoring process. For the reference it would open a raw avenue for the person doing research in ITS based application.

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