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A Survey done on Intelligent Tutoring System: Practical Analysis of SQL Tutor

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ABSTRACT

An Intelligent Tutoring System (ITS) is a computer system that is used to tutor students in some domain of study. It is different from other educational systems as it uses knowledge to guide the teaching strategies. ITS tries to optimize the student's mastery of domain knowledge by controlling the introduction of new problems, concepts and instruction/feedback. The focal point of the teaching process is student model which lets know what the student knows about a particular domain. Constraint Based Modeling is a new idea proposed by Ohsollon, focuses on learning from errors. The constraint based model says everything is allowed until it does not violate the constraint. Whereas, Student Based Model says about what the student know or what they believe to know. Here we are combining these two approaches. Any particular domain is based on some basic principles, if the student knowledge satisfies those principles (constraints), the Tutoring System is successful. The SQL - Tutor is an existing ITS that uses a constraint-based model. In SQL-Tutor constraints are LISP code fragments, where domain structural knowledge is incorporated into the constraints via ad hoc functions which is as loose as Ohsollon description.

I am trying to give a more specific representation of constraints in the form of user defined functions. This approach has two advantages:

i. Constraints are easier to author

ii. They can be used to generate solution on demand.

This approach seems to improve learning performance in the classroom. The authoring tool helps to develop a quick and efficient system.

Keywords: Intelligent Tutoring System, Constraint Based Modeling

I. INTRODUCTION

Computers have been used in education since sixties. Even in today's era computer has become an integral part of everyone's life. Present generation is smarter in terms of using all these gadgets and tools. Students are also using them in their academic activities. So keeping this in mind a lot work had already been done in this field i.e., making Intelligent Tutors for them. When comparing students' performance with earlier it has shown a large difference today. Keeping all these things in intelligence I begin to work on a promising approach Constraint Based Modeling.

II. METHODS AND MATERIAL

1. Intelligent Tutoring System

Intelligent Tutoring System (ITS) are used to tutor students in some specific domain of study without any human intervention. They are different from conventional Systems or Computer Aided Instructions because of adapting students(users) individual need (student model). SQL Tutor is one good example of ITS. It used approximate approach of Constraint Based Modeling (CBM).This approach is still young as it lacks in details. CBM was tailed by Ohlsson in 1994 , is an effective approach to build domain model. In this thesis

I am trying to practically analyze CBM approach through SQL TUTOR and more effective way of building ITSs.

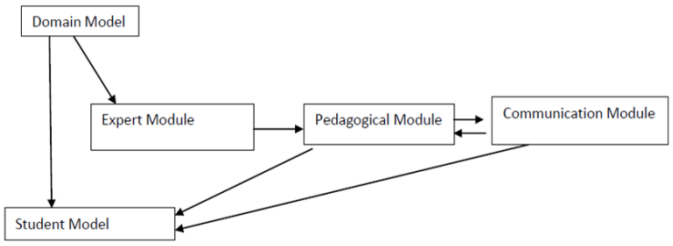

Figure 1. Architecture of ITS

Two main models of ITS are:
1. Domain Model
2. Student Model

Different Approaches in ITS

1. Model Based Tracing
2. Constraint Based Modeling

2. Constraint Based Modeling

CBM model was presented by Oshllon(1994), which suggests learning from errors. In order to learn from errors error recognition and error correction are most important phases. For error recognition student‘s fundamental should be clear where he is lacking and hence cannot correct error.

CBM uses this approach and hence detects error using its knowledge domain where the student is lacking. In this approach we are concerned with student‘s action but in what state they are at present time. Till the students don‘t reach the state known as problem state student can perform any action they want. Therefore domain model is an ordered pair: (Cr, Cs) ,where Cr is relevance condition and Cs is satisfaction condition as suggested by Oshllon.

Example

SQL TUTOR uses Constraint Based Modeling approach. This is a knowledge – based tutor which helps in learning SQL. The work was started in 1996. First evaluation was done in 1998(Mitrovic). The aim of this tutor was to provide easy-to-use system and understanding the needs of individual student. Currently there are 600 constraints that are compiled into RETE networks. The system deals with only SELECT statement. Several versions of SQL Tutor are available. The Windows Version and the latest being web enabled version.

Figure 2. Windows Version

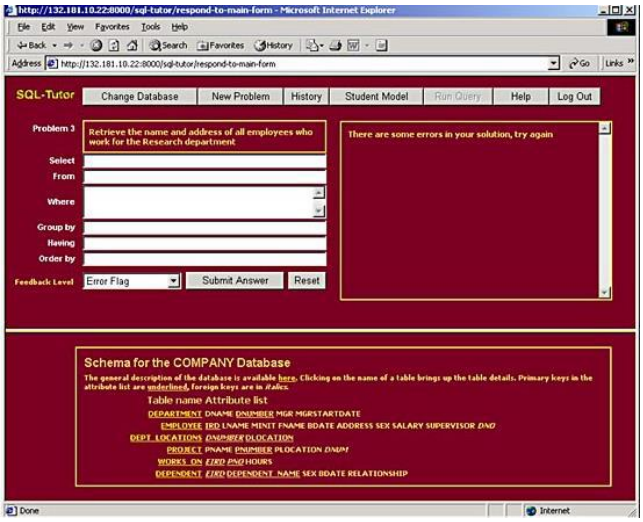

Figure 3. Web Enabled Version

3. ITS in different fields

EDUCATION

E-Teacher is an intelligent agent that supports personalized e-learning assistance. It builds student's role while observing student performing in online classes. So e-Teacher uses the information from student's prole to indicate their individualized courses of action that help in learning process.

The Mathematics Tutor helps students resolve word problems using fractions, decimals and percentages. The tutor accounts the success rates when student is working on the problems and subsequent problems that are predicted to student's level will be selected and an estimated desirable time will be given to the student to solve the problem.

Why2-Atlas is an ITS that analyse students explanation of physics rules. The students input their work in paragraph form and the program converts them into a proof by making hypothesis of student beliefs based on their explanations. In doing, misconceptions and incomplete explanations are played out. The system then addresses these issues through a talk with the student and asks the student to correct them.

Corporate Training

SHERLOCK is used to train Air Force technicians to diagnose problems in the electrical systems of F-15 jets. The ITS creates faulty schematic diagrams of systems for the trainee to locate and diagnose. The ITS provides diagnostic readings allowing the trainee to decide whether the fault lies in the circuit being tested or if it lies elsewhere in the system. Feedback and guidance are provided by the system and help is available if requested.

Cardiac Tutor: The Cardiac Tutor's aim is to support advanced cardiac support techniques to medical personnel. The tutor presents cardiac problems and, using a variety of steps, students must select various interventions. Cardiac Tutor provides clues, verbal advice, and and feedback in order to personalize and optimize the learning. Each simulation results in a detailed report on student's performance.

Constraint Representation

The constraint representation in SQL TUTOR uses pattern matching approach through domain independent MATCH function in which each solution is compared with student solution or ideal solution. And domain specific TEST function whose value is matched with a variable. This representation consists of three logical connectives AND, OR, NOT and functions MATCH, TEST.

Match

This function is used to match a arbitrary number of terms in a student or correct solution.
Syntax: (MATCH <solution name><clause name> (pattern list))
Solution name- Student or correct solution
Clause name-SQL clause to which pattern applies

Pattern list- set of terms that match to individual element in the solution being tested.

Test

After performing a MATCH to determine the existence of some sequence of terms, we wish to further test the value of one or more variables that were bound. This is carried out using the TEST function, which is a special form of MATCH thataccepts a single pattern term and one or more variables.

Test_Symbol

Now we need also to be able to test characters within the value of a term. To test this we add the function TESTSYMBOL, which acts precisely like the MATCH function, except it accepts a variable name as a substitute of a clause name, and further parses the value of the variable binding into individual characters, before applying the match pattern. For example, to test for a valid SQL string in the variable ?str:
(TEST_SYMBOL SS ?str ("" ?* ""))
This test would succeed for values of ?str such as "'Kubrick'" for example, but fail for "'Smith" because of the missing closing quote. The syntax is as follows:
(TEST_SYMBOL <solution><var> (pattern))

4. Literature Survey

Drill and practice (also known as ―Drill and Kill‖) is fitted to the behaviorist model with repeated practice on lower-level cognitive skills.

T**utorials** Most common technique used in CAIs. In this way, the computer gives the information, guides the apprentice through the system, allows the apprentice to exercise and then assesses the apprentice.

Simulation In this manner, the learner works with a simulation of the actual universe. Simulation is used where it is not viable to provide the learning in real-life (for example, pilot training).

Games (Gloor, 1990). In this mode of learning, there is generally a competitive factor(e.g. time constraints or a race). The estimate is to reinforce knowledge that the learner is assumed to possess.

Reviewing these changes and improvements in 1982, a term was coined, Intelligent Tutoring System (Sleeman and Brown) to illustrate these evolving systems and make a distinction them from the previous CAI systems. The implicit assumption about the learner now focused on learning-by-doing. They classified the existing ITS as being computer-based (1) problem-solving monitors, (2) coaches, (3) laboratory instructors, and (4) consultants. (Sleeman & Brown, 1982).

They are good examples **of adaptive educational system.** In place of using static information, adaptive systems use domain knowledge to actively decide what to show the student next. Techniques such as active hypermedia (Brusilovsky 2000; Murray, Piemonte, Khan, Shen and Condit2000) combine and format content for presentation, depending on what the student has so far seen and understood. Intelligent coaches (Lajoie and Lesgold 1992) make the interface of online ―coaches‖so that they provide effective help. The key attribute of ITS is use adaptive aspects like , domain and student model , teaching strategy..

III. RESULTS AND DISCUSSION

Problems in Representation

The constraint language is limited by the need to be able to generate solutions that satisfy the constraint set. This means that it must be possible to build the set of constructs that satisfies each constraint. This gives rise to two limitations: the inability to call external functions, and a lack of recursion.

IV. CONCLUSION

As we have seen in previous chapters that the SQL TUTOR uses CBM approach in its development. But this approach has also some limitations . These limitations can overcome by using solutions used in chapter 4,5,6. So After applying these solutions CBM becomes more promising and efficient approach for building ITS systems than earlier. ITS is a budding field and needs more work It is achieving high level of success due to some earlier research work like Congitive Tutors and CBM Tutors. CBM is easier to develop and most suitable for open-ended domains. Building tutors is a big task. In this thesis I am making an attempt to make this task easier, effective wuth lesser efforts.
Intelligent tutoring systems have come a long way since the 1970s. They are now being used in real classroom settings and are producing significant gains in student performance. The next step is widespread deployment, but it has been held back by the huge effort required to build effective systems. We have addressed this by enhancing constraint-based modelling, a simple but effective method, so that it may provide all the domain and student modelling requirements of an ITS. We have developed algorithms and tools that make CBM tutors much easier to build, making CBM a practical tool for ITS deployment. With the number of students ever increasing and the internet opening up the prospective audience of education software, ITS is poised to have an enormous positive impact on education in the near future.

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