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Intelligent Tutoring System Using Rule-Based And Case-Based: A Comparison

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Abstract

Intelligent Tutoring System (ITS) is one of the solutions due to the need for on-demand tutoring among students nowadays. ITS may provide the students unlimited access to effective and affordable personal tutoring anytime, anywhere. It is developed specially to give a one-to-one tutoring to students while simulating the student-teacher learning environment. The tutoring process includes giving notes, examples, exercises, hints and corrections, similar to in-class tutoring process. The main objective of this study is provide a systematic view of implementing two different artificial intelligence techniques which are rule based and case based reasoning in an ITS for primary school children in the subject of Mathematics. It was built on cognitive models, which represent the knowledge a student might posses about specific subject. The scope of this research covers only for standard six students in the subject of Mathematics, especially in fraction. The objective of this research is to compare the implementation of rule-based and case-based in ITS, based on five features; knowledge representation, learning, search strategy effectiveness, user feedback, incomplete input and knowledge base expansion.

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Keyword: Intelligent Tutoring System; Artificial Intelligence; Cognitive Models

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1. Introduction

Students' understanding and perception on a certain subject at school depends on how much they are tutored directly by the teachers. Students especially from the primary school, needs special attention from the teachers where they need the one-to-one direct tutorial to make them learn faster and understand better. The more they are given direct tutorial, the better they will understand and the faster they learn new topics. Involving students in tutorial is an important process. Students need to participate in the tutorial to understand what they are learning. Tutoring students without students' participation will lead to shorter term of memory. In order to store something in their long term memory, students need to participate actively in the tutorial.

One of the problems with the current educational method is lack of one-to-one tutorial during school hours. Maybe several students may afford to get personal teacher to come to their house after school to revise what they have learned in school. It is quite impossible for teachers in school to satisfy all the students need because of the limited time and work congestion. As a result some students are still stuck at some chapter and miss the boat to proceed to the next chapter.

In search for the alternative solution for this problem, several tutoring approaches were developed including the Computer Based Training (CBT) and courseware. This computer software was designed to provide students with the alternative way of one-to-one tutorial and at the same time improving their understanding and perception. This solution at first was seen as success as more of this software was developed to provide education tutorial to the students. Students also accept this method easily as they prefer to interact with computer which they find it interesting and fun. However the problem for this method is that the system's tutoring approach is prefix and static. Therefore, this tutoring approach is not the optimal solution and does not reflect the real tutoring between students and teachers at school. The approach does not adapt to students' capability and that it assumes all students are the same. There are needs for a system that can really simulate the one-to-one tutoring between students and teachers and adapts to the students' capability.

An ITS is a system that not only provide tutoring materials to students, it also adapts to the students capability. Every student has different capabilities and has different type of understanding. Advance students, are less dependent to tutoring materials and able to learn new things faster than the weaker ones. This various type of students' capability allow the needs of ITS to be initialized.

Rule-based expert system is one of artificial Intelligent (AI) approach that is use in expert system. Rule is defined as a statement that expressed in the IF (antecedent) and THEN (consequent) form. If the antecedent is true, then the consequent is also true. While, rule base is the knowledge system whose knowledge base contains a set of production rules. Meanwhile, rule-based expert system is an expert system whose knowledge base contains a set of production rules (Negnevistky, 2002).

Case-based reasoning (CBR) is a family of artificial intelligence techniques, based on human problem solving, in which new problems are solved by recalling and adapting the solutions of similar past problems (Kolodner,1993). According to Aamodt and Plaza (2000), Case-based reasoning is a problem solving paradigm that in many respects is fundamentally different from other major AI approaches. Instead of relying solely on general knowledge of a problem domain, or making associations along generalized relationships between problem descriptors and conclusions, CBR is able to utilize the specific knowledge of previously experienced, concrete problem situations (cases).

The aim of this paper to provide a systematic view of implementing two different artificial intelligence techniques which are rule based and case based reasoning in an ITS for primary school children in the subject of Mathematics. We also aim to differentiate both techniques capabilities in this scope.

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