Adaptive Learning with Intelligent Tutoring Systems: Challenges and Innovations

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ABSTRACT

The term "intelligent" refers to a system with the ability to know what to teach, when to teach and how to teach. Intelligent Tutoring System (ITS) is a branch of Artificial Intelligence (AI) that attempts to simulate a "humanlike" tutoring capabilities. Such tutoring system can be effective because it can answer to the specific needs of student,which will be guide for to slow learners, to challenge rapid learners and to monitor the progress of each student as well as establishing a training plan very well. IT has the ability to understand, learn, and solve problem, if arises.
This paper discusses the state of the art of Web-based Intelligent Tutoring System and suggests ways to improve the current Web-based ITSs

Keywords: *AI,ITS, KBS, CAI,CAL,ALGOL, KNOWLEDGE*

I. INTRODUCTION

Artificial intelligence (AI) is a property of machines which gives the ability to copy the human thought process. It is concerned with the design of intelligence in an artificial device. This term was defined by McCarthy in 1956.

There are two ideas in the definition.

- Intelligence
- Artificial device

An **intelligent tutoring system** (**ITS**) is a computer system that aims to provide immediate and customized instruction to learners, usually without requiring intervention from a human teacher like online teaching. ITS can act as machine teacher for student which solves the problem of the learner.

The traditional ITS model contains four components:

- Expert Module / Domain model / cognitive model / expert knowledge model
- Student Module / model tracing
- Curriculum Module / Tutoring model
- Interface Module.

- Expert Module contains information about the subject knowledge domain. Its contain the concepts, rules, and problem-solving strategies of the domain which is to be learned.
- Student Module can be thought of as an overlay on the domain model. It contains information about the student's understanding of the knowledge domain. It is considered as the core component of an ITS.
- Curriculum Module contains rules that allow it to judge how well the student's understanding of the subject domain matches actual knowledge structure.
  It also accepts information from the domain and student models and makes choices about tutoring strategies and actions.
- Interface Module presents the user with a uniform environment within which instruction, analysis, remediation, and user driven learning may take place.
  The user interface component integrates three types of information
- Knowledge about patterns of interpretation and action
- domain knowledge needed for communicating content; and
- knowledge needed for communicating intent

ITS projects can vary tremendously according to the relative level of intelligence of the components. For example, a project focusing on intelligence in the domain model may generate solutions to complex and novel problems so that students can always have new problems to practice on, but it might only have simple methods for teaching those problems, while a system that concentrates on multiple or novel ways to teach a particular topic might find a less sophisticated representation of that content sufficient. When multiple components contain intelligence, homogeneous or heterogeneous representations can be used.

An ITS typically aims to replicate the demonstrated benefits of one-to-one, where students would otherwise have access to one-to-many instruction from a single teacher (e.g., classroom lectures), or no teacher at all (e.g., online homework).

ITS Algorithm:-
ITS can also be classified by model tracing tutor algorithm. It track students' progress and keeps them within a specified tolerance of an acceptable solution path.

Knowledge:-
Knowledge is information combined with experience, context, interpretation and reflection. It is intangible, boundary less, and dynamic, and if it is not used at specific time in a specific place, it is of no value there is no knowledge without someone knowing it. Although knowledge can be represents in and often embedded in organizational process, routine, and networks and sometimes in document repositories, it cannot truly originate outside the heads of individuals.

The knowledge in the system can be used to support a variety of tasks on the part of the student, has not yet been addressed by most systems

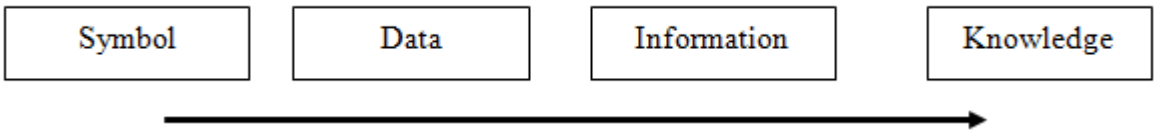

Fig. 1 Step by step

Knowledge can be represented as-

Character --- String --- Graph --- Picture

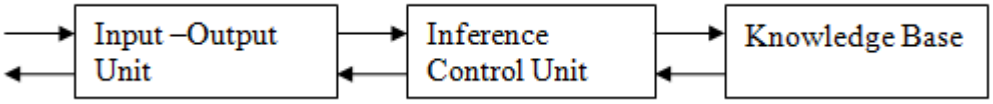

Fig. 2 Knowledge Based System

II. INTELLIGENT TUTORING SYSTEM

ITS also called Knowledge-based Tutors is computer-based educational system that allow emulation of human tutor. ITS used artificial techniques that can determine what to teach, how to teach and learn certain teaching relevant information about student being taught. This requires the representation of a domain knowledge (called the Domain Knowledge) instructor's or teacher's_knowledge and the student learning state. Through the interaction of these models, an ITS is able to make judgments about the student understanding and progress. Instructions can then be tailored by the Pedagogy Module to the student's requirements, automatically, without the intervention of a human instructor.

ITS is more intelligent than other predictable tutoring systems like Computer Aided Instructions (CAI). The creation of the ALGOL programming language in 1958 which was enabled in many schools and universities for beginning to develop Computer Assisted Instruction (CAI) programs and Computer Aided Learning (CAL) which are lacking "the flexibility and learner-centered orientation of ITS". An ITS includes educational knowledge and a model of the student's knowledge level and understanding.

Architecture of ITS:-
Schank have described the roles of artificial intelligence in education very well. The suitability of computer-based agents to intelligent tutoring is also argued. Same argument goes for the web-based ITS's. Can a web based intelligent tutoring system really help students learn a more valuable deeper understanding of concepts?

To achieve this objective, it is essential to impart cognitive skills to every component of an ITS. Further, the implementation of web-based ITS must make extensive use of the recent trends in web technology. Such architecture possesses the following parts:

- An XML-embedded knowledge base that represents the domain knowledge.
- An Intelligent Java servlet engine that generates the course material.

- An Intelligent web server that sequence the course material to the student.
- An Intelligent web client that presents the material to the student and takes feedback from students.
- An Intelligent database that maintain the record of students' work and performance.

Principles of ITS :-

An intelligent tutoring system should enable the student to work to the successful conclusion of problem solving.

1. Represent student competence.
2. Communicate the goal structure.
3. Provide instruction in the problem solving context.
4. Promote an abstract understanding of the problem-solving knowledge.
5. Minimize working memory load.
6. Provide immediate feedback on errors.
7. Adjust the grain size of instruction with learning.
8. Facilitate successive approximations to the target skill.

Advantages of ITS:-

Intelligent Tutoring systems(ITS) are effectively used for teaching the course of the specified domain with following features and benefits:

1) Increases student / instructor ratio from around 1:1 so that it reduce training costs extremely, and still deliver close to a one on - one learning experience.
2) Shortens training time and / or improve skill level.
3) Automatically optimizes individual learning.
4) 4)Builds "student module" for each student, that includes: Performance on training exercises.
5) Details of information / remediation received
6) Details of knowledge mastered / failed / unknown / misunderstood.
7) Performance on remediation activities.
8) Student preferred learning style.
9) Automatically receive each student's actions, so that an ITS can provide & maintain a complete record of student performance like

- Aid instructor in helping student.
- Provide a permanent record of student's training performance.
- Aids and documents achievement of job mastery in critical skills.
- Reduce administrative work
- Adaptively improves its teaching style with each student the more the ITS works with a student.

III. APPLICATIONS

During the rapid expansion of the web boom, new computer-aided instruction paradigms, such as e-learning and distributed learning, provided an excellent platform for ITS ideas.

Areas that have used ITS include

- natural language processing,
- machine learning, planning,
- multi-agent systems,
- anthologies, semantic Web, and
- Social and emotional computing.
- multimedia,
- object-oriented systems,
- Modeling & simulation, and
- Statistics
- Education
- Corporate training and industry

IV. LIMITATIONS

Intelligent tutoring systems (ITS) are expensive both for to develop and to implement. The research phase paves the way for the development of systems that are commercially viable. However, the research phase is often expensive; it requires the cooperation and input of subject matter experts, the cooperation and support of individuals across both organizations and organizational levels. Another limitation in the development phase is the conceptualization and the development of software within both budget and time constraints.

V. CONCLUSION

Intelligent Tutoring System makes teaching and learning highly which will become more effective because of envolment of each and every student action.

These characteristics play an important role in both the design and evaluation of ITS systems and also the advantages of the intelligent tutoring system.

The conclusion of this paper is the introduction of a number of generic characteristics and behavior that should be provided by the architecture of an ITS.

The future scope for research includes actual implementation and verification of the proposed architecture.

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