The Basic Role of Knowledge Base Systems in Intelligent Education System

Purushottam Lal Bhari¹ & Dr. Ashok Jetawat²
¹Research Scholar under Guidance of Dr. Ashok Jetawat.
Dept. of Computer Science and System Studies, Mewar University, Chittorgarh
²Director, Aravali Institute of Technical Studies, Udaipur

Abstract: Traditionally, Intelligent Education Systems (IES) are dedicated to learners. They help them learn at their own pace according to need, following a curriculum tailored to their individual needs and receiving individualized feedback. Knowledge Base Systems (KBS) play an important role in building intelligent systems. According to this survey, their aim is to facilitate the whole teaching/learning process by helping the teacher as well as the student. These tools have been provide an increasing interest to integrate the teacher as an end-user of the ITS. KBS is the back-end tool used in all intelligent machines. This paper presents the role of Knowledge Base Systems for building intelligent teaching systems. We illustrate the concept of KBS with intelligent systems. This study explored such uses of retaining large amount of data in artificial brain or human brain. The paper is based upon a quantitative and qualitative study. It is produced after gathering feedback through questionnaires from two hundred forty nine students. Results of the questionnaires illustrate that intelligent tutoring systems using knowledge base system in higher education could boost the efficiency, effectiveness, and quality of graduates.

Keywords: Intelligent Education Systems (IES), Intelligent Teaching Assistant (ITA), Knowledge Base System (KBS).

1. Introduction

According to science human brain can store several thousand folds of world’s knowledge. After that it is said that human brain is not fully utilized as its capacity. Advances in human knowledge are tied directly to the ability to analyze to form information, then process it into knowledge and communicate it to others as required. A human brain has approximately several nerve cells called biological neurons and it is probably the most complex and least understood part of the human body. The human brain is continuously thinking in declarative and procedural way for problem solving, but how does the human mind work it is a mystery till today. This new millennium brought us an opportunity to attack all such questions with the help of new knowledge, new tools and new resources & approaches. Development of systems that make use of knowledge, wisdom and intelligence is a step towards meeting this challenge. The capture and redistribute expertise has ability of the intelligent systems that significant implications on development of a nation, population or commodity. These types of systems allow documentation of one or more expert knowledge and utilize the knowledge for problem solving in cost effective manner. It permits for, during a controlled manner, the import of experience in numerous areas that the state lacks, the export of information with reference to domestic areas of experience, and therefore the duplication and distribution of scarce information during a value effective manner. Thus area unit as of experience that the chosen domain or region is deficient in or possesses completely are potential candidates of the knowledge-based systems. Although synthesized information could be a key part for fulfillment, in several businesses it's a missing piece. A major quantity of Gross National Product (GNP) is invested in transferring information through education and coaching. The AI systems effectively distribute the scarce resources for the development process, they behave intelligently. The Knowledge-Based Systems (KBS), which are a step towards an intelligent system that can be justified when a few individuals have the majority of the knowledge.

2. Knowledge Base System

Knowledge representation and reasoning is the field of artificial intelligence devoted to representing information about the world in a form that a computer system can utilize to solve complicated tasks like as diagnosing a medical condition or having a dialog in a natural language. Basically knowledge representation incorporates findings from psychology about how humans solve problems and represent knowledge in order to design formalisms that will make easier to design and build the complex systems. Knowledge representation and reasoning also incorporates...
findings from logic to automate various kinds of reasoning, like the application of rules or the relations of sets and subsets.

Generally knowledge-representation is the field of artificial intelligence that concentrates on designing of computer representations that capture information about the real world that can be used to solve complex problems using domain knowledge. So the justification for information illustration is that standard procedural code isn't the most effective formalism to use to unravel advanced issues. The knowledge representation makes complex software easier to define and maintain than procedural code and can be used in expert systems.

2.1 Knowledge Based System Structure

Knowledge-Based System (KBS) is one of the important part of any intelligent system and major family members of the Artificial Intelligence environment. With convenience of advanced computing facilities and alternative resources, attention is currently turning to a lot of and a lot of rigorous tasks, which could need intelligence. The society and trade are getting data familiarized and trust completely different experts’ decision-making ability. KBS will act as a skilled on demand while not dalliance, anytime and anyplace. KBS will economize by leverage skilled, permitting users to perform at higher level and promoting consistency. One could contemplate the KBS as productive tool, having data of quite one skilled for long amount of your time. In fact, a KBS may be a pc primarily based system that uses and generates data from wisdom, information and data.

These systems are capable of understanding the information under process and can able to take decision based on the residing information/knowledge in the system whereas the traditional computer systems do not know or understand the data/information they process. Basically the KBS consists of a Knowledge Base and a search program called Inference Engine (IE) of KBS. The IE is a software program, which infers the knowledge available in the knowledge base as different formats. The knowledge base can be used as a repository of knowledge in various forms. Inference Engine may include an empty Work Space to store temporary results and information/knowledge pieces. Inference Engine performs tasks to processing knowledge of facts. As an expert’s power lies in his explanation and reasoning capabilities then the expert system’s crediability also depends on the explanation and reasoning of the decision made by the system. Normally, human beings have an ability to learn new things and forget the unused knowledge from their brains. This type of learning is essential component of KBS and the life of KBS may vary according to the degree of such simulation. It is an advantage that the KBS may be either manually updated (manual update) or automatically updated by machine. When it updated automatically, the process is called machine learning. Ideally, the basic frame of a KBS has no needs to be modified basically. In addition to all these, there should be an appropriate User Interface provided, which may have the Natural Language Processing facility. The components are shown in following figure.

![Figure 1 Knowledge Base System structure](image)

The structure of knowledge base system is an important part of every intelligent machine. This structure has knowledge, wisdom and intelligence for decision support systems. Every intelligent machine has ability to take decision on base of knowledge base system. The knowledge base system structure has components to store knowledge, to process knowledge and behave intelligently.

2.2 Knowledge Based System Development

The knowledge of the intelligent system is stored in his mind in a very abstract way. Sometimes also every intelligent system may not be familiar with knowledge-based systems terminology and the way to develop an expert system. Mainly the Knowledge Engineer (KE) is responsible person to transfer, acquire and represent the experts’ knowledge in form of computer system. Experts, People, Students, Teachers and Testers are the main users’ groups of knowledge based systems. The overview of KBS development process is as well as:
The knowledge acquisition process incorporates typical fact finding methods like questionnaires, record reviews, interviews and observation to acquire factual and explicit knowledge. Basically these types of methods are not much effective to extract tacit knowledge that is stored in subconscious mind of experts and reflected in the mental models, values, insights, and actions of the intelligent systems. For this, techniques like concept mapping, concept sorting, and protocol analysis are being used.

According to system the acquired knowledge should be immediately documented in a knowledge representation scheme. The selected knowledge representation strategy might not be permanent at this initial stage. However documented knowledge will lead the knowledge engineer or developer to better understanding of the system and provides guidelines to proceed further. Scripts, rules, frames and semantic network are the typical examples of knowledge representation scheme in artificial intelligence. It is responsibility of the knowledge engineer to select appropriate knowledge presentation scheme that is natural, transparent, efficient, and developer friendly in environment. One may think for hybrid knowledge representation strategies like rules within the frames in slots like “on request” and “on need”; semantic network of default frames etc.

2.3 Knowledge Based System Tools

A KBS tool is a group of software instructions and utilities taken to be a software package designed to assist the development of knowledge-based systems for different intelligent systems. Typical programming languages are mostly used like java and framework like .NET can also be used in KBS development frequently on personal computers. These programming languages are general purpose and also being used to develop other application than AI applications as required. Knowledge-based systems shell with the readymade utilities of self learning; inference and explanation etc. like Java Expert System Shell (JESS), Vidwan, GURU are more specific and can also be useful to develop knowledge-based systems. Tailor made KBS can be developed using programming languages like LISP and Prolog. Both LISP and Prolog are most useful programming languages in field of artificial intelligence.

John McCarthy published a remarkable paper in 1960 showing a handful of simple operators and a notation for functions that one can build a whole programming language. He named this language Lisp; it is for “List Processing,” because one of his key ideas was to use a simple data structure called a list for both code and data. It is first artificial intelligence purpose programming language. There are various versions of Lisp available namely KLISP and C Language Integrated Production System (CLIPS).

Prolog is a powerful logic programming language. It is a logic programming general purpose fifth generation language used for artificial intelligence application development. It has a purely logical subset, known as pure Prolog, as well as a number of extra logical features also included. Prolog has its roots in formal logic and it is declarative in nature. The program logic is expressed in terms of relations and execution is triggered by running queries over these relations. According to Robert Kowalski the first Prolog system was developed by Alain Colmerauer and Phillipe Roussel in 1972.

Some packages software like MATLAB, Java NNS (Java Neural Network Simulator) etc. and markup open sources based tools like AIML (Artificial Intelligence Markup Language) and Project D (developed in AIML and open source) can also be used to develop KBS. The Knowledge Query Manipulation Language (KQML) used by multiple agents and intelligent agents for agent’s communication environment. Common KADS and Protégé also help in assisting KBS development process in user friendly way.

Knowledge base system tools are available in wide category. According to Stefan Robertson and John K C Kingston there are approximately 200 KBS tools are frequently used. Alty (1989) sets the products into three main groups based primarily on functionality which also happen to differ markedly in the platforms on which they are available. They are categorized as Shells, Languages, and Toolkits. Besides support towards knowledge acquisition and representational features, there are other features like price, ease of use, flexibility, vendor availability and support, user friendliness, and documentation support from the tool need top be considered before final selection.
3. Knowledge Based System and Education

KBS is the most need of intelligent tutoring systems. Traditionally, artificial intelligence systems such as intelligent systems have been limited by their lack of commonsense knowledge and by the brittleness of their knowledge bases. An expert system could be used in a variety of problem domains with a self-extending capability. For example, expert systems dedicated to troubleshooting parts in a very advanced system might frequently update their information bases by process the data contained in new technical reports and revised technical manuals. Knowledge Base Decision Support System (KB-DSS) has been mainly benefited from the advancement in Artificial Intelligence technology in the past few decades. Mainly AI technology has enabled the KB-DSS to have new functions such as better knowledge modeling and reasoning.

The education sector encompasses a range of distinctive characteristics up to now as data generation and use area unit involved, one amongst that in all probability renders it distinctive and several other others that need explicit thought. Geared toward learning and knowledge creation is the outstanding feature of education. This establishes a sharp divide between education and other sectors such as engineering and health are different to each other, a divide that has implications for the respective sector’s relationships to their knowledge bases. A second characteristic is that education does not have just one knowledge base only. There are at least two sets of knowledge bases and them arguably more depending on the level of abstraction employed. The relationship of the knowledge actors to the base is quite different on the measurement and application issues because different knowledge base systems are treated differently. It is concerned by teachers that there is a basic distinction between subject knowledge and professional knowledge. It can be generally seen that a science teacher must be immersed in the science knowledge base or appropriate subsets of it. It is most common truth that every teacher only perfect in his own field. Initial training for science teachers is in principle indistinguishable from the training received by others seeking a science based career and it is necessary for them to properly absorb the canons of scientific method as well as specific bodies of knowledge associated with physics, chemistry and so on.

A third characteristic of education is the diversity of knowledge and the multiplicity of their relationships to the various knowledge bases. A man of science can conduct assessments that draw on psychological feature, affection and attainment-related metrics. A doctor can advise on medical aetiology and prognosis and the way these act with psychological feature development. Speech and physiotherapists can contribute to assessment and programming on the idea of their specific disciplines. An education officer will impact on the situation in the light of knowledge of legal requirements, prevailing good practice and local resource allocation procedures. The teacher isn't solely the recipient of those various information inputs however should draw on his/her own education knowledge domain to include them into associate degree applicable learning program.

Knowledge Base System is the key in achieving opportunities for better decision-making and competitive advantages for education system. Academic sector have significant opportunities to apply Knowledge Base System practices to their teaching/learning system. A wide verity of intelligent systems are available in education system, they use knowledge base systems and more capable then human intelligence. The knowledge base system is an artificial brain that can store more knowledge than human brain and present in expert manner.

4. Introduction to intelligent education systems

Intelligent education systems (IESs) are computer programs treated as intelligent teaching assistants that are designed to incorporate techniques from the artificial intelligence community in order to provide tutors which know who they teach, what they teach and how to teach it. Artificial Intelligence attempts to produce in a computer behavior which, if performed by a human, would be described as intelligent: IESs may similarly be thought of as attempts to produce in a computer behavior which, if performed by a human, would be described as 'good teaching'. Intelligent tutoring assistant always behave intelligently. The design and development of such tutors lie at the intersection of cognitive psychology, educational research and computer science; this intersecting area is normally referred to as cognitive science.

Intelligent Tutoring Systems have been more often dedicated to learners than to teachers. Generally the teacher is perceived as the administrative manager of the authoring systems and sometime is one of the designers of the system because the intelligent system needs an intelligent knowledge system that designed using knowledge of teachers. But it is not very common to read details about the triangular pedagogical relationship.
between the student, the system and the teacher, or about the teacher’s features. According to the past decade, an increasing interest in the teacher’s role and his/her integration as a target user of the ITS. Basically the original aim of Intelligent Tutoring System is to help learners to increasing interest to learn. It is also a better approach that an additional way to help learners is to help the teachers or instructors to teach better and more efficiently. These kinds of approaches create a good environment for learners. This is particularly needed when teachers are a scarce resource. Generally the face-to-face interactions and the pedagogical expertise they provide are extremely valuable in education system. Some Intelligent Tutoring Systems include the teacher as a final user of the system, known as Intelligent Teaching Assistant systems (ITAs). Under this broad type of Intelligent Education Systems, we can find more detailed names such as pedagogical assistant and collaborative learning.

ITAs are dedicated both to learners and teachers and their purpose is to support the educational or training process in an intelligent manner by assisting the teacher in his/her tasks as well as helping learners to learn. According to survey they can take a significant load off the teachers. Teachers can assist them in tedious or complex tasks, report problems of students, keeps track of the student’s results, whilst helping learners to practice at their own pace in an adapted environment, tailored exercises and receiving feedback. The teacher remains present in the learning process with an ITA. Assisting the whole learning process rather than replacing the teacher and treating him/her as a target user is the key philosophy of an ITA. There teachers remain in control of the teaching and are seconded with an ITA.

5. Retaining large amount of data in memory

The most suitable method of retaining large amount of data in memory is Artificial Brain or human brain. According to respondents Artificial Brain is more suitable method for retaining large amount of data. Human brain has unlimited space for data storage but can not utilize full space by any human being. Artificial Brain can retrieve data and store large amount of data according to capacity of used memory. In this survey 87% student from 249 student support of artificial brain to retaining large amount of data in memory. Because of an artificial brain can store knowledge, facts, wisdom and intelligence with hug capacity. The survey result of respondents is formulated and presented using pie chart.

6. Conclusion

Knowledge-based decision support systems (KB-DSS) have been investigated for nearly three decades and have supported real education system. It has been recognized that KB-DSS have improved decision maker’s performance, especially in terms of speed and consistency. This paper presents that the knowledge base systems play an important role in development of intelligent educational machines. Artificial brain is able to retaining large amount of data as compared to human brain. In survey 87% student support to artificial brain to retaining large amount of data in memory. It means knowledge base systems play an important role in making strong of artificial brain for intelligent machines, they can be used in education system for teaching, learning and other purposes like result preparation, expressions evolution, examine exam copies etc. So the knowledge base system is strong tool for developing intelligent educational systems. A new architecture is proposed for future work in developing more intelligent KB-DSS.

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8. Author

Purushottam Lal Bhari is a research scholar of Mewar University Gangrar, Chittorgarh-Raj (India). After completing MCA from IGNOU, New Delhi he is pursuing PhD on “To study the Role of Artificial Intelligence in Indian Education System”.

Dr. Ashok Jain is a Director of Aravali Institute of Technical Studies, Udaipur-Raj (India). After completing MTech (IT) and MBA, he did his PhD from Mohan Lal Sukhadia University on “A Critical Evaluation of e-Governance Implementation in Rajasthan State”. He is having more than 34 years of experience in the field of information technology. He is the member of “Special Interest Group on e-Governance” of Computer Society of India. His area of interest is to study and provide consultancy for successful implementation of e-Governance and e-Learning implementation in India. The author received “Rashtriya Ratana Award” in 2002 for individual outstanding performance. He is the research guide and life member of CSI, IE (India), IIIE, IIMM, ISTD and many professional bodies. He is also the active member of Internet Governance Capacity Building Program (IGCBP) whose head office is in MALTA.