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A WAY TO IMPLEMENT THE ADVISORY SYSTEM FOR HIV/AIDS- KNOWLEDGE BASED SYSTEM

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Abstract

Knowledge is playing an inevitable role in human life. To get appropriate consultations regarding HIV/AIDS from medical experts become problematic in most of the critical environments. The well-known procedures are also become complicated when the HIV/AIDS infected patient's shows reluctant to approach the domain experts face to face. The solution is developing a knowledge based system that creates a user friendly environment for the users to get the right suggestions at the right time. In this study an attempts is made to develop knowledge based system that provide the necessary advice to HIV/AIDS patients. To design the system the necessary tacit and explicit knowledge has been collected from experts and codified documents respectively, which is then modeled using decision tree knowledge modeling technique. A rule based knowledge representation method is followed to easily build the knowledge-based system using prolog programming language. Users interact with the system through the user interface which accepts users query and display the result generated by the system. The system is currently designed to provide advice for HIV/AIDS patients. Users' evaluation shows that the performance of the system is promising. Performance to rectify lack of physicians or expert in the domain. The finding of this research is related with a possibility to remove the ignorance of HIV related facts and also provide a guidance regarding the advisory and treatment. A better way therefore to improve this system is localizing the user interface using Ethiopian local languages to enhance the usability of the knowledge base system. Mobile advisory is the crucial issue in this time; so other researchers can take more consideration on this part.

Keywords: Knowledge, Advisory, Expert, Medical.

Introduction

Our mental capacities are so important to our everyday lives and our sense of self that human kind has given itself the scientific name homo-sapiens; man the wise. The field of artificial intelligence (AI) attempts to understand these capacities better known as intelligent entities. One of the large scale applications of the field of AI is the development of knowledge-based systems. A knowledge- based computer program containing knowledge of human experts in a particular domain among the various types of expert systems[1]. An expert system is a knowledge-based computer

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program containing knowledge of human experts in a particular domain such as medicine, agriculture, law, etc.[2] An expert system is a computer application that solves complicated problems that would otherwise require extensive human expertise. To do so, it simulates the human reasoning process by applying specific knowledge and interfaces. Expert systems also use human knowledge to solve problems that normally would require human intelligence. These expert systems represent the expertise knowledge as data or rules within the computer. These rules and data can be called upon when needed to solve problems. Books and manual guides have a tremendous amount of knowledge but a human has to read and interpret the knowledge for it to be used. There are several major application areas of expert system such as agriculture, education, environment, law manufacturing, and medicine power system etc. expert systems can be applied to various tasks of medicine domains such as generating alerts and reminders, diagnostic assistance, therapy critiquing and planning, agents for information retrieval, image recognition and interpretation as well as counseling. Knowledge-based system for healthcare are widely studied where accuracy of diagnosis and efficiency of the system for various healthcare services are examined [3].The application of Information Technology research and development to support health and medicine are an emerging research area in artificial intelligence. MYCIN developed in 1970 at the Stanford University [3], is one of the most popular medical expert system used to assist to diagnose and treat blood disease. The problem of human medication and patient treatment are the main reason behind to develop expert system. Knowledge-based systems are necessitated by the limitations associated with conventional human decision making processes, including human expertise is very scarce, human get tired from physical or mental workload, humans forget crucial details of a problem, humans are inconsistent in their day to day decisions, humans are limited working memory, humans are unable to comprehend large amount of data quickly, humans are slow in recalling information stored in memory, and humans lie, hide and die. AIDS is caused by the Human Immunodeficiency Virus (HIV). The virus was discovered in France in 1983 and in the United States in 1984. In the United States, it was initially identified in 1981[4]. In 1986, a second virus, now called HIV-2, was

also discovered in Africa.[4] Most medical and research community worldwide, [3] noted that the AIDS epidemic is a serious problem for the society. In the last quarter of a century human immune deficiency virus infection and acquired immune deficiency syndrome (HIV/AIDS) became an increasing global health, social and economic concern. There is a need to exploit the potential of KBS in the area of HIV/AIDS. HIV/AIDS is caused by the Human Immunodeficiency Virus (HIV).

Related work

In recent years, Knowledge Based Systems (KBS) and related Expert System (ES) have become increasingly popular computer software approaches used to solve a wide variety of application problems, in a scientific domain, that are sufficiently complex as to require significant human expertise for their solutions.[9-11] KBS are more appropriate for use in solving semi structured or unstructured problems, i.e., problems for which a numerical model does not exist. Knowledge Based Systems are computer systems that advise on or help solve real world problems which would normally require a human expert's interpretation. Such systems work through problems using a computer model of expert human reasoning. Thus, they are designed to reach the same conclusion that human expert would be expected to reach if faced with a comparable problem.[12] Knowledge-based systems, also known as (expert systems), are computerized systems that use information to provide relevant advice and problem solutions within a specific domain. Knowledge-based systems enable expert knowledge to be accessed 24 hours a day, even when an expert is unavailable. They also provide a means to preserve information that otherwise might be lost when an expert retires. Unlike conventional algorithms that embed domain knowledge within the program, inference engines are problem independent. Such independence provides versatility, enabling the inference engine to be applied to any number of domains by simply changing the knowledge base. The same diagnostic inference engine could be effectively applied to the medical field as well as automobile repair or trouble shooting a manufacturing process. The beauty of this independence is that it allows the programmer to focus on the domain knowledge, often expressed as facts and rules, without having to debug faulty algorithmic code.[13]

Knowledge-Based System (KBS) is one of the major family members of the AI group. With availability of advanced computing facilities and other resources, attention is now turning to more and more demanding tasks, which might require intelligence. The society and industry are becoming knowledge oriented and rely on different experts' decision-making ability. KBS can act as an expert on demand without wasting time, anytime and anywhere. KBS can save money by leveraging expert, allowing users to function at higher level and promoting consistency. One may consider the KBS as productive tool, having knowledge of more than one expert for long period of time. In fact, a KBS is a computer based system, which uses and generates knowledge from data, information and knowledge. These systems are capable of understanding the information under process and can 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. Knowledge-based or expert systems are computer programs designed to solve problems, generate new information (such as a diagnosis), or provide advice, using a knowledge base and an inference mechanism. Most systems include a user interface and some explanation capability as well. Davis characterized knowledge-based systems as focusing "on the accumulation, representation, and use of knowledge specific to a particular task," but addressed the expanded views of such systems made possible by "the ability to use the same knowledge in several different ways".[14]

There are various definitions for knowledge-based systems given in the KBS literature. A knowledge-based system as a computer system that attempts to store and organize a great deal of knowledge in a specific domain area. It makes the user to solve the problems and create an logical inferences.[15] Knowledge-based system as computer programs rich in facts, relations, and procedures and plans to support human decision-making.[16] A knowledge-based system as an interactive computer-based decision making tool that utilizes both factual and heuristic knowledge extracted from domain experts using various techniques for solving problems.[17]

One can see that, KBSs differ significantly from conventional computer programs. Conventional computer programs deal primarily with quantitative

data and are based on algorithms or mathematical formulas and sequential procedures that lead to a solution using data to solve problems.[18] On the other hand knowledge-based systems target on solving problems that do not have a traditional algorithmic solution by implementing the heuristic human reasoning through specific techniques, procedures and mechanisms.[19] The ability of the intelligent systems to capture and redistribute expertise has significant implications on development of a nation, commodity or population. Such systems allow documentation of one or more expert knowledge and utilize the knowledge for problem solving in cost effective way. It allows for, in a controlled manner, the import of expertise in various areas that the nation lacks, the export of knowledge relating to domestic areas of expertise, and the duplication and redistribution of scarce knowledge in a cost effective manner.[20]

Decision making, often viewed as a form of reasoning towards action, has raised the interest of many scholars including philosophers, physicians, economists, psychologists, and computer scientists for a long time. Any decision problem aims to select the "best" or sufficiently "good" action(s) that are feasible among different alternatives, given some available information about the current state of the world and the consequences of potential actions.[21] Advisory systems provide the advices and assist for solving problems that are normally solved by human experts. They can be classified as a type of expert systems.[21], [22] Both advisory systems and expert systems are problem-solving packages that mimic a human expert in a special area. These systems are constructed by eliciting knowledge from human experts and coding it into a form that can be used by a computer in the evaluation of alternative solutions to problems within that domain of expertise. Advisory systems do not make decisions but rather help guide the decision maker in the decision-making process, while leaving the final decision making authority up to the human user.[23] The decision maker works in collaboration with the advisory system to identify problems that need to be addressed, and to iteratively evaluate the possible solutions to unstructured decisions. For example, a manager of a firm could use an advisory system that helps assess the impact of a management decision on firm value[24] or an oncologist can use an advisory system to help locate brain tumors.[25] In these two

examples, the manager and the oncologist are ultimately (and legally) accountable for any decisions/diagnoses made. Traditionally rule-based expert systems operate best in structured decision environments, since solutions to structured problems have a definable right answer, and the users can confirm the correctness of the decision by evaluating the justification provided by explanation facility.[26] Luger[27] has presented some limitations of current expert systems. Advisory systems are designed to support decision making in more unstructured situations which have no single correct answer. In unstructured situations cooperative advisory systems that provide reasonable answers to a wide range of problems are more valuable and desirable than expert systems that produce correct answers to a very limited number of questions.[28]

Proposed work

Timely and accurate information about HIV/AIDS are vital and beneficial to get valuable suggestions from medical experts in many ways. Severe conditions are usually without the personal consult for physicians, the infected patients are advised to don't take any self-meditations. After the confirmation for each and every stage for the infected level, if there is any laboratory examination is required, this knowledge based system also provide an advice about that indications and related information's. A continuous monitoring and precautions require minimizing the adverse effect of HIV/AIDS infected patients due this harmful virus. For this reason, if they (HIV/AIDS infected patients) need advice to interact with this knowledge based system to get the aid advise and the prescriptions for some preliminary medicine. A considerable amount of data related to the HIV/AIDS infected patients which will be collected, coded, verified, validated, and entered into the knowledge bases in order to provide the appropriate response for the user's query. Such kind of data will time to time be selectively retrieved, updated, maintained, statistically and synoptically analyzed and then provided to the appropriate clients to get clear advice/suggestions regarding their doubts.

The internal verification and validation process involves a combination of predictions as well as the suggestions from the expert physicians regarding to solve the users query. The combinatorial analysis of very complicated decision variables makes the knowledge based system to getting delay response due to the reason for some symptoms of the HIV/AIDS will be correlated with many other diseases. Especially the knowledge based system to store the knowledge in a given domain of medical expertise and possesses a means of processing that knowledge using programs and rules. Query Analyzing is the heart of the process for the implementation knowledge based system. The standard procedure for facilitating users request will be generally include: storage, retrieval, statistical analysis, transfer and exchange. Generally, it is very broad and capable of performing a variety of tasks that are related to the HIV/AIDS advisory and diagnostic mechanism. This application for human-computer communication (Interface Interaction) mechanism of the query submission and getting appropriate response is little bit complex for the users to easily understand and exploit many of its facilities. Moreover, the direct incorporation of some fundamental concepts about the symptoms for different stages of HIV/AIDS providing precaution to avoid the advising side effects from severe complications. A number of work has been carried out in the medical filed regarding to develop the knowledge based system for different applications. In spite of all the complications the infected patients never showing any hesitations to consult with physicians regarding to get treatment. But, the infected HIV/AIDS patients are very much hesitates to consult with physicians for more critical situation also, it will be help more to overcome such kind of environments.

The general thing to solve this application, to provide the suggestions/advice for HIV/AIDS infected patients in a clear manner without any hesitation at any time. But, the major drawback is the clients/infected patients should possess at least some education background to interact with this knowledge base. In most of the circumstances, the HIV/AIDS infected patients are illiterate background and poor knowledge about the computer literacy. It may affect the hit ration to freely interact with this application. The user interface is shown in the fig. no. 01.
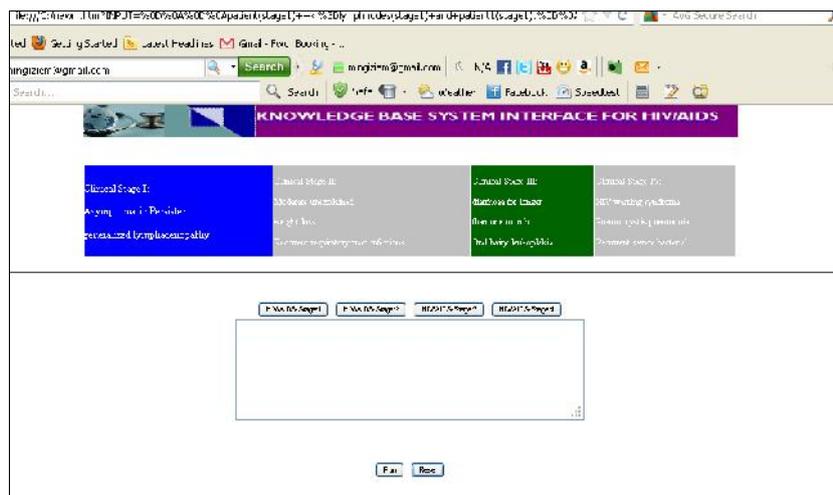
Fig. No.01: User Interface

Conclusion

The evaluation of the existing interfaces for knowledge based systems in the domain of heath care and medical diagnostics as well as the advisory system is somewhat making useful to the current implementation. Even though much number of medical knowledge based systems exists in the current trends, most of them need a huge educational background to perform the interactions and get appropriate suggestions. This research work aims to develop a prototype Knowledge based system for HIV/AIDS that offer an advisory for infected patients as well as physician. Knowledge-based system technology has been employed for designing and interacting with the proposed interface and it provides suggestions based on the HIV/AIDS infected patients queries.

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